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QUALITY ASSURANCE PROJECT PLAN:

EVALUATION OF ASBESTOS AND OTHER RELEASES FROM HANDLING AND GRINDING OF RESIDENTIAL BUILDING DEBRIS FROM HURRICANE KATRINA

Prepared by:

T. David Ferguson and Roger C. Wilmoth

U.S. EPA, Office of Research & Development
National Risk Management Research Laboratory
26 West Martin Luther King Drive
Cincinnati, OH 45268

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Holly Wootten, Cadmus — Date

Seth Schultz, The Louis Berger Group — Date

Craig Napolitano, The Louis Berger Group — Date

Lauren Drees — 5/6/08

Lauren Drees, Quality Assurance Manager — Date
ORD, NRMRL, U.S. EPA, Cincinnati, OH

Dave Ferguson — 5/7/08

David Ferguson,, Task Order Manager — Date
ORD, NRMRL, U.S. EPA, Cincinnati, OH

5/6/08

Roger C. Wilmoth, Program Manager — Date
ORD, NRMRL, U.S. EPA, Cincinnati, OH

5/6/08

Robert Olexsey, Program Director — Date
ORD, NRMRL, U.S. EPA, Cincinnati, OH

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ORD, NRMRL, U.S. EPA, Cincinnati, OH

Roger C. Wilmoth, Program Manager — Date
ORD, NRMRL, U.S. EPA, Cincinnati, OH

Robert Olexsey, Program Director — Date
ORD, NRMRL, U.S. EPA, Cincinnati, OH

ACKNOWLEDGMENT AND DISTRIBUTION LIST

Acknowledgment

The following individuals participated in preparation of this Quality Assurance Project Plan.
U.S. EPA, ORD, NRMRL:
David Ferguson
Roger Wilmoth
Bob Olexsey

Contractor Project Team:
Cadmus, Louis Berger, RTI

Distribution List

Same individuals listed in Acknowledgment with the addition of the following:

U.S. EPA:

Susan Fairchild, OAR
John Cardarelli, OSWER
David Cleverly, ORD
Lauren Drees, ORD
Paul Groff, ORD
Esteban Herrerra, Region 6
Paul Lemieux, ORD
Pam Mazakas, OECA
Robin Segall, OAR
Dennisses Valdes, OSWER
Jeffrey Yurk, Region 6
Nancy Jones. Region 6
David Eppler, Region 6
Tony Zimmer, NHSRC
Sella Burchette, OSWER
Randy Hill, OECA
Ronnie Crossland, Region 6
Phyllis Flaherty, OECA
Brian Gullett, ORD
Fran Kremer, ORD
Matt Lorber, ORD
Andy Miller, ORD
Richard Shores, ORD
Joe Wood, ORD
Todd Martin, ORD
Ron Rutherford, OECA
Gary Newhart, ERT

LDEQ:

Wayne Desselle
Dwight Bradshaw

SECTION 1 PROJECT TASK/ORGANIZATION

1.1 Project Organization

The U.S. EPA's Office of Research and Development (ORD) is conducting this pilot project in support of U.S. EPA's Office of Enforcement and Compliance Assistance (OECA) and Region 6. The Sustainable Technologies Division (STD) of U.S. EPA's ORD National Risk Management Research Laboratory (NRMRL) will be responsible for measuring the ambient air releases of asbestos, particulate as PM_{10}, and TSP/metals metals from debris handling and from operation of a grinder. Cadmus is the prime contractor to EPA's STD and will have overall responsibility for the implementation of this Quality Assurance Project Plan (QAPP).

The roles and responsibilities of key project personnel from EPA and Cadmus are summarized in Figure 1-1 and Table 1-1. The project structure along with the technical personnel selections are designed to provide efficient management and a high level of technical competence to accomplish this project.

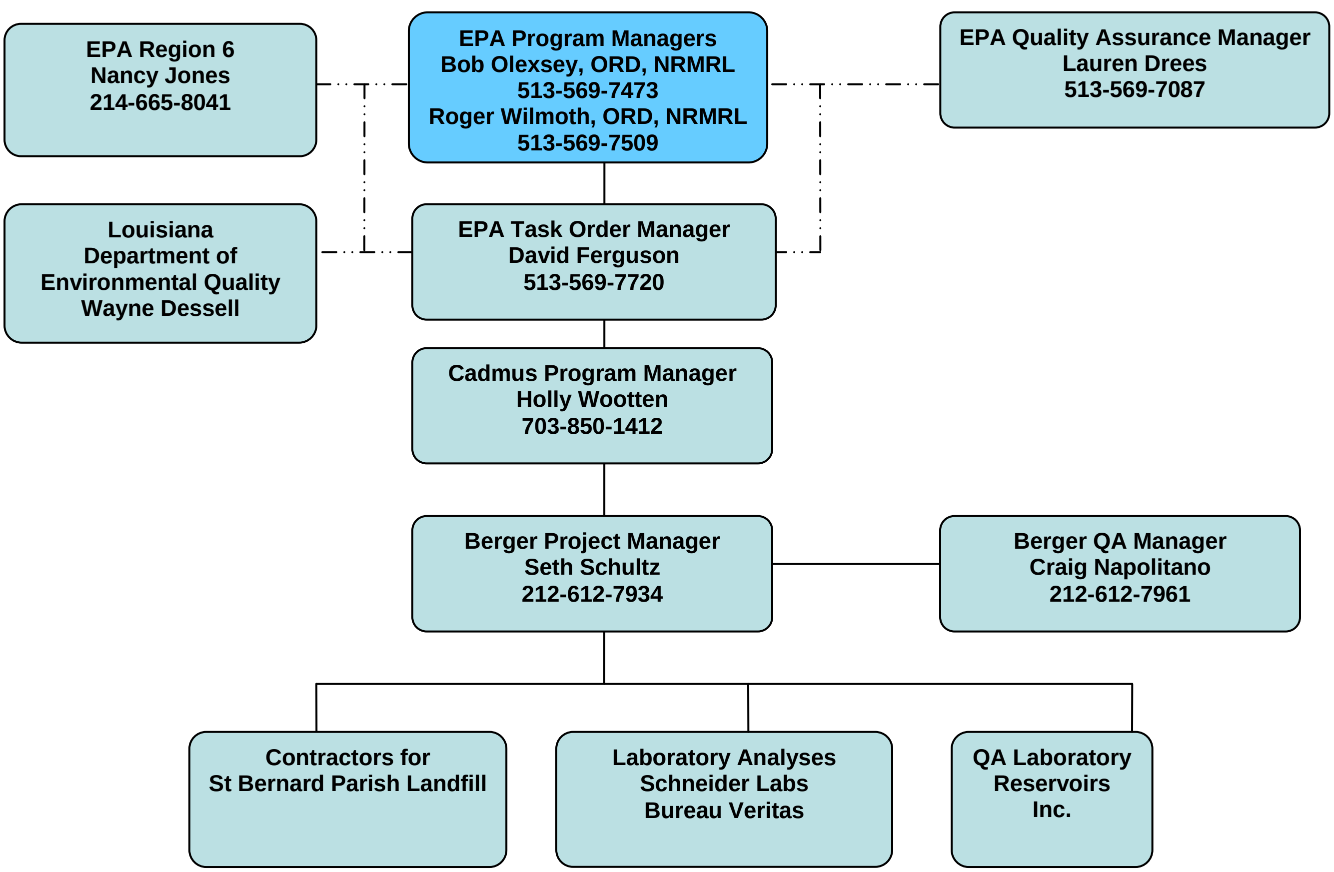

Figure 1-1. Roles and responsibilities.

Table 1-1. Roles And Responsibilities Of Key Project Personnel

Personnel	Role and Responsibility
Bob Olexsey, U.S. EPA, ORD, NRMRL	*Program Director,* will have overall coordination responsibilities for ORD.
Roger Wilmoth U.S. EPA, ORD, NRMRL	*Program Manager*, will have overall technical responsibility for this project.
David Ferguson, U.S. EPA, ORD, NRMRL	*Task Order Manager (TOM),* will direct the administrative functions of the project and ensure that it is proceeding on schedule and within budget. Point of contact for Cadmus.
Lauren Drees, U.S. EPA, ORD, NRMRL	*QA Manager*, will review and approve QAPP. Will provide QA oversight to ensure that the planning and plan implementation are in accordance with the approved QAPP. In addition, will direct a field audit and a laboratory audit.
Holly Wootten, Cadmus, Inc. Seth Schultz, Louis Berger	*Project Manager*, will have overall administrative and technical responsibility for Cadmus/Berger and its sub-contractors to ensure that data collection and analysis and the technical report meet the planned study objectives. Maintain close communication with the EPA TOM. Ensure that the project is completed in accordance with the approved QAPP and all personnel fully understand the QAPP.
Craig Napolitano, The Louis Berger Group	*QA Manager*, will review the QAPP and perform data validation.
Schneider Labs	Will provide laboratory analysis of PM_{10}, TSP/Metals samples
Bureau Veritas	Will provide primary laboratory analysis of asbestos samples
Reservoirs Inc	Will provide quality assurance (QA) secondary sample analysis for asbestos samples
EEG	Industrial Hygiene subcontractor to Berger. Conducted building inspection, will perform worker sampling.

SECTION 2 PROBLEM DEFINITION/BACKGROUND

2.1 Background

On August 29, 2005, Hurricane Katrina made landfall near New Orleans, Louisiana (LA) breaching the levees that protect the city from Lake Pontchartrain. The hurricane also damaged the coastal regions of southern Louisiana, southern Mississippi, and southern Alabama. Approximately 260,000 residential buildings in the City of New Orleans were identified as structurally unfit for reoccupation.

The State of Louisiana requested assistance in this massive effort of demolition, debris handling, and ultimately volume reduction and final disposal of the waste material. Grinding of the debris has been proposed as a potential means of volume reduction of the debris while minimizing potentially harmful environmental impacts.

OECA has issued a *No Action Assurance* (NAA) letter to that would allow the EPA to proceed with an evaluation of the grinder technology. EPA wants to determine if potential grinder activities will be protective of human health and the environment. This air monitoring plan developed by the EPA Office of Research and Development will be coordinated with OECA and LDEQ to ensure that the proposed grinder activity is well integrated into the overall approach being taken regarding the NAA and will provide data of sufficient scientific quality to judge the environmental effectiveness of grinder use on asbestos-containing residences.

This project is being conducted to provide data that will enable EPA to evaluate the potential use of this activity for future disasters. The primary purpose of the Sustainable Technology Division's (ORD/NRMRL/EPA) involvement in this project is to measure the ambient air releases of asbestos from debris handling and grinding activities; i.e., the Grinding Process. Other target analytes in the ambient air include ones envisioned as potential releases from the grinding activity and include TSP/ metals and particulate as $PM_{10.}$ The project will be conducted at the Paris Road Landfill/debris collection site in St. Bernard Parish, LA.

2.2 Grinder

EPA is in the process of selecting a grinder that will be used in the pilot test. Preliminary tests used a grinder manufactured by Continental Biomass Industries, Inc. (CBI). The skid-mounted Annihilator-Series grinder is shown in Figure 2-1. As an example, a schematic and the specifications of "The Annihilator" are shown in Figure 2-2. The Annihilator is designed for primary processing of demolition debris and municipal solid waste. It is powered by a 630 HP diesel engine and offers a 100+ ton/hr throughput. A smaller, yet still a low speed, grinder is expected to be used for this evaluation.

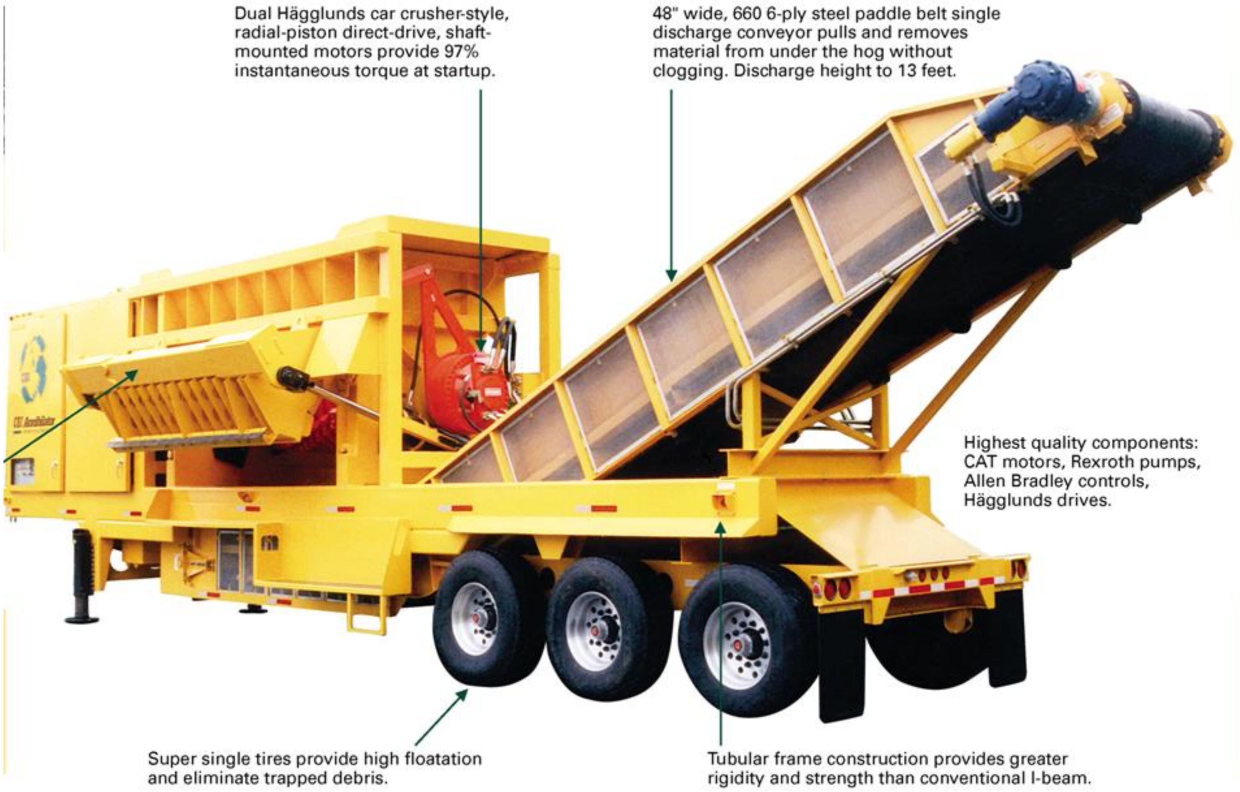

Figure 2-1. Typical grinder.

Specifications

Overall	
Length	51' 10"
Height	13' 6"
Width	9' 5"
Weight	105,000 pounds
Box	
Length	10' 5"
Width	6' 8"
Output conveyor	
Length	30'
Width	48"
Rotor	
Length	10' 4"
Diameter	42"
Weight	20,000 pounds
Hammers	42
Hammer Weight	95 pounds, each
Tips, Reversible	22 pounds, each

Anvil	
Weight	8,000 pounds
Support	5" dia. high strength, hardened steel pivot pins and bushing
Throughput	100+ tons/hour
Power	
Diesel	CAT C-16, 630 HP; standard
Electric	Two (2) 300-500 HP motors
Electrical	Radio remote control for all functions, with full, independent mechanical backup

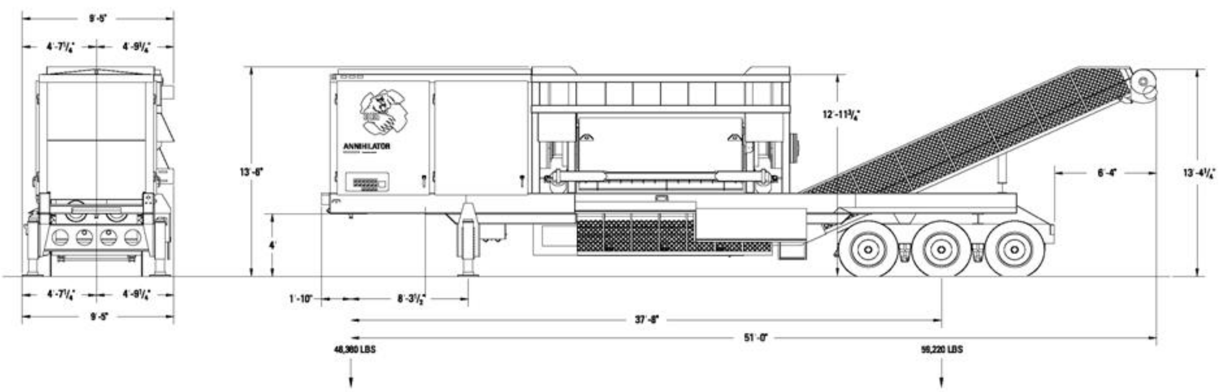

Figure 2-2. Schematic and Specifications of CBI Annihilator Shredder.

2.3 Objectives

The goal of this study is to assess the asbestos and other releases from a **grinder operation. This process includes** handling and grinding of asbestos-containing residential building debris to accomplish the grinding operation. This information will be used to support a risk assessment of the grinder process. Measured/modeled air concentrations will be compared to applicable health effects benchmarks, as well as to background concentrations. The risk assessment approach is described in a separate document.

The following primary objective will guide the design and implementation of this project with appropriate consideration of the secondary objectives.

2.3.1.1 Primary Objective

1. To determine the ***airborne asbestos concentrations using transmission electron microscopy (TEM)*** released from the grinder operation.

2.3.1.2 Secondary Objectives

1. To determine if the ***asbestos (TEM) concentration during grinding is statistically equal to or greater than the background concentration***.

2. To determine the ***concentrations of asbestos in the settled dust*** released from the grinder operation.

3. To determine the ***airborne concentrations of fibers using Phase Contrast Microscopy (PCM), particulate as PM_{10}, and Total Suspended Particulate (TSP)/metals***[1] released from the grinder operation.

4. To determine ***worker asbestos exposure concentrations (TEM), worker fiber exposure concentrations (PCM), and worker lead concentrations*** released from the grinder operation.

5. To determine the ***TCLP***[2] ***metals and asbestos concentrations*** in the grinder output.

6. To determine the ***background concentrations of airborne asbestos, PM_{10}, and TSP/metals***.

7. To estimate the volume reduction achieved by the grinder operation and the time required to grind a unit volume of debris and to document the production rate.

[1] Metals include antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, lead, manganese, mercury, nickel, selenium and silver

[2] TCLP metals include arsenic, cadmium, chromium, selenium, barium, mercury, lead and silver

PROJECT/TASK DESCRIPTION

2.4 Technical Approach

The project will gather data on the release of airborne asbestos, TSP/metals, and particulate as PM_{10} during volume reduction of asbestos-containing building debris from residences that have been destroyed by Hurricane Katrina and have been subsequently demolished under a *No Action Assurance* authorization from EPA's OECA to the LDEQ. The buildings that will be used in the project are located in Saint Bernard Parish, LA. and have been previously evaluated to assure that they contain Regulated Asbestos -Containing Materials (RACM).

The grinder field evaluation will be conducted at the Paris Road Landfill/debris collection site. The site is located on Paris Road in St Bernard Parish. LA. A stockpile of RACM buildings will be available onsite for the test.

The test will be conducted in one eight-hr grinding/sampling event. Data from this effort will be used to estimate the emission rate of the grinder as a point source and then these estimates will be used in a separate effort in conjunction with an air model to estimate risk to receptors under a variety of conditions.

2.4.1 Asbestos and Lead Inspection of Buildings

*Asbestos—C*andidate residential buildings were inspected by a State of Louisiana Department of Environmental Quality (LDEQ) licensed Asbestos Consultant. The initial surveys were conducted by St. Bernard Parish contractors under their protocol, which included making some assumptions as to the positive asbestos content of specific materials (e.g., floor tile, transite siding, etc.). These inspections will be verified by a separate EPA contractor to quantify those materials judged positive by assumption under the St. Bernard Parish contractors. The objective of the inspections is to determine the type and quantity of asbestos-containing materials (>1% asbestos) present in the buildings (see Appendix A for the building Assessment QAPP).

Collection of samples will be conducted in accordance with EPA's Asbestos Hazard Emergency Response Act (AHERA, 40 CFR §763). The initial list of houses and their asbestos assessments will be supplied to EPA by Parish Contractors.

Lead in Paint— Lead in paint film ("paint chip") samples will be collected from the interior finishes (painted gypsum wallboard and millwork) and from the exterior surfaces (clapboard siding and window sash/frame) from each of the buildings.

2.4.2 Building Debris

A contractor will transport residential building debris that contains asbestos-containing materials (see 2.4.1 "*Asbestos and Lead Inspection of Buildings"*) to the site.

2.4.3 Site Assessment Air Sampling (Asbestos)

Ambient background air monitoring will be conducted for asbestos in air and settled dust. This sampling is described and accounted for in the QAPP "*Evaluation Of Asbestos And Other Releases From The Handling And Burning Of Residential Building Debris Using Air-Burner Technology From Hurricane Katrina***"** dated May 1, 2008.

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2.4.4 Perimeter Air Monitoring (Asbestos and TSP/Metals)

A series of stationary air monitors will be positioned to measure the release of airborne asbestos fibers and airborne particulate from handling and grinding of asbestos-containing debris. The movement of the released asbestos fibers and particulate is affected by the prevailing winds (transport) and turbulence (dispersion); the amount of the fibers and particulate removed due to deposition is influenced by their respective physical properties; and the amount of asbestos fibers and particulate released is affected by the debris handling, debris loading, and operation characteristics of the grinder.

To account for the uncertainty in the wind direction on a given test day as well as the change in wind direction during a given test day, the primary air sampling design is based on a concentric ring approach rather than on an upwind/ downwind comparison approach.

The perimeter air monitoring network will consist of two concentric rings around the grinder operation. The asbestos monitors will be placed in each ring at approximately 20-degree intervals measured along a radius from the center of the grinder operation. The monitors for asbestos will be placed at ten-ft above the ground on the primary ring (hereafter referred to as Ring 1). Three downwind samplers for TSP/metals and particulate matter as PM_{10} will be placed at a height of five- feet above the ground on Ring 1. On the secondary ring (hereafter referred to as Ring 2), all monitors will be placed at five-ft above ground with identical number of monitors as Ring 1and illustrated in Figure 2-3.

Asbestos samples will be collected at a flow rate of four lpm for eight hours for a target air volume of 1,920 liters. In addition, low-volume samples will be collected at flow rate of two lpm for eight hours for a target air volume of 960 liters in Ring 1. The two-lpm samples will be archived and only analyzed if the higher volume samples are overloaded. Samples for TSP/metals will be collected at a flow rate of approximately 44 cfm for a minimum of eight hours for a target air volume of 600 m^3. The samplers will be run continuously during the eight-hour testing. Six each of these samplers will be located downwind, three on each ring.

Ring 1 will be placed as close to the grinder operation as possible without the grinder activities (e.g., debris handling and trucking) interfering with the operation of the samplers. It is anticipated that the radial distance from the grinder operation will be 60-80 feet. The asbestos samplers must be a minimum of ten feet away from any high volume samplers (TSP, PM_{10}) to assure that they are not influenced by the larger volume samplers. Ring 2 will be placed at a radial distance of approximately 300 ft from the grinder operation. The estimated number of ambient air samples that will be collected for asbestos and TSP/metals is presented in Table 2-1.

In addition, separate ambient samples for asbestos, PM_{10} and TSP/metals will be collected at various sites during grinding activities in and around the project as shown in the photo below. They are:

1. West of the trailers at the URG Office compound
2. Inside the fence on the URG/Parish property west of Paris Road
3. West of the Motel on Paris Road
4. West of SDT Transfer Station
5. West of the URG Inspection tower
6. Six background sample locations for Asbestos and 3 background sample locations each for TSP and PM_{10}/metals to be determined.
7. Downwind in boat 500-1000 feet from grinder (Asbestos air only)

These samples will be collected under the same conditions as Ring 2.

Paris Rd Landfill Sampling Areas

Figure 2-3. Paris Road Landfill sampling locations.

Table 2-1. Perimeter Air Monitoring During Operation of Grinder Process

Ring	Sample Type	Air Volume	Number of Samples			
			Test Run (Eight Hours)			Total Samples
Asbestos[a]						
R-1 @ ten-ft above Ground	Eight-hr period	1,920 L		18		18
	Duplicate	1,920 L		2		2
	Field blank	0		1		1
	Total Samples			**21**		**21**
	Eight-hr period	960 L		18		18
	Duplicate	960 L		2		2
	Field blank	0		1		1
	Total Samples[b]			**21**		**21**
R-2 @ five-ft above Ground	Eight-hr period	1,920 L		18		18
	Duplicate	1,920 L		1		1
	Field blank	0		1		1
	Total Samples			**20**		**20**
Ambient Locations	Five + 6 background + boat			12		12
	Field Blank			1		1
	Total Samples			**13**		**13**
			Total			**75**
TSP/Metals						
R-1 @ five-ft above Ground	Eight-hr period	600 m^3	3			3
	Duplicate	600 m^3	1			1
	Field blank	0	1			1
	Total Samples					**5**
R-2 @ five-ft above Ground	Eight-hr period	600 m^3	3			3
	Duplicate	600 m^3	0			0
	Field blank	0	1			1
	Total Samples					**4**
Ambient Locations	Five +3 background		8			8
	Field Blank		1			1
	Total Samples					**9**
			Total			**18**
Ring	**Sample Type**	**Air Volume, L**	**Number of Samples**			
			Test 1	**Test 2**	**Test 3**	**Total Samples**
Particulate PM_{10}						
R-1 @ five-ft above Ground	Eight-hr period	600 m^3	3			3
	Duplicate	600 m^3	1			1
	Field blank	0	1			1
	Total Samples					**5**
R-2 @ five-ft above Ground	Eight-hr period	600 m^3	3			3
	Duplicate	600 m^3	0			0
	Field blank	0	1			1
	Total Samples					**4**
Ambient Locations	Five + 3 background		8			8
	Field Blank		1			1
	Total Samples					**9**
			Total			**18**

[a] Samples will be analyzed both for asbestos (ISO 10312:1995) and total fibers (NIOSH 7400, A Rules).
[b] These samples will only be analyzed if high volume (1,920 liter) samples are overloaded.

2.4.5 Perimeter Air Monitoring (Particulate as PM_{10})

PM_{10} samplers will be placed at the six locations in Rings 1 and 2, and at the six ambient sites. These samplers will provide particulate concentration data during the eight-hour test. These samplers will be positioned at a height of five-feet above ground. The estimated number of particulate samples to be collected and analyzed is presented Table 2-1.

2.4.6 Settled Dust (Asbestos)

Settled dust samples for asbestos will be collected as an indicator of the amount of these particulates from the debris handling and grinder operation that may deposit onto the soil. The settled dust samplers will be placed on Rings 1 and 2 at the same locations as the 18 perimeter air samples at a five-foot height; i.e., the samplers will be distributed at 20^{o} intervals. Sample collection will begin immediately prior to the start of grinding activities, continue during the eight-hour test when ACM debris is ground, and end one hour after grinding operations are halted.

The estimated number of settled dust samples to be collected and analyzed for asbestos is presented Table 2-2.

Table 2-2. Settled Dust Samples On Perimeter Rings (Asbestos)

Ring	Sample Type	Number of Samples	Total Samples
Asbestos			
R-1 @ five-ft above ground	Settled Dust	18	18
	Duplicate	2	2
	Field Blanks	1	1
	Total Samples	**21**	**21**
R-2 @ five-ft above ground	Settled Dust	18	18
	Duplicate	1	1
	Field Blanks	1	1
	Total Samples	**20**	**20**
Ambient Locations	Five + 6 Background	**11**	**11**
	Total Samples	**11**	**11**
	Total Samples for Table		**52**

2.4.7 Worker Air Monitoring (Asbestos and Lead)

All workers directly involved with the grinder operation will wear personal protective equipment as specified in the site-specific Health and Safety Plan (HASP). In accordance with OSHA Standards 29 CFR §1926.1101 (Asbestos) and 29 CFR §1926.62 (Lead), for each worker that would typically be on the job (Loader & Operator) personal breathing zone exposure concentration to asbestos fibers and lead will be measured. Also four observers/samplers will be monitored. In addition, this monitoring will provide a reasonable characterization of the asbestos and lead in air closest to the source of any potential release.

Personal samples for asbestos and lead will be collected to determine the eight-hour time-weighted average (TWA) concentration for comparison to the OSHA Permissible Exposure Limits (PELs). The estimated number of worker exposure samples to be collected and analyzed for asbestos (and total fibers) and lead is presented in Table 2-3.

Table 2-3. Worker Exposure Monitoring

Worker	**Air Volume, L**	**Number of Samples**	**Total Samples**
Asbestos			
Loader & Operator (2)	960	2	2
Other Workers/ Observers (4)	960	4	4
Field blanks	0	1	1
Duplicate	960	1	1
Total Samples		**8**	**8**
Lead			
Loader & Operator (2)	960	2	2
Other Workers/ Observers (4)	960	4	4
Field blanks	0	1	1
Duplicate	960	1	1
Total Samples		**8**	**8**

[a] Samples will be analyzed both for asbestos (ISO 10312:1995) and total fibers (NIOSH 7400, A Rules).

2.4.8 Grinder

2.4.8.1 Grinder Input

The debris to be used in the grinder will be provided by Parish contractors, arriving in marked burrito-wrapped bundles (plastic wrapping). The debris will be visually inspected as it is received and deposited at the grinding location. It will be wetted with water during the unloading process and then covered with tarps or plastic until it is used for the grinding test. It will be also wetted with amended water (minimum 0.5% to 1% or more surfactant) during the process of loading it into and feeding the grinder. The loader will be weighed onsite empty using a portable scale to determine the tare weight and will be weighed again as it is fully loaded enroute to the grinder. At the conclusion of the test, the loader will be again weighed empty (to measure the weight of fuel that was used). The beginning and ending tare weights will be averaged to determine the tare weight to be used to determine the total mass of debris that was transported to the grinder.

2.4.8.2 Grinder Output

The TCLP metals content of the grinder output "debris" will be measured. One composite sample will be collected every four hours. Each composite sample will be composed of four hourly grab samples; i.e., one sub-sample will be collected every four hours. A separate composite sample of the grinder output will be concurrently collected for asbestos analysis. The estimated number of debris samples to be collected and analyzed for TCLP metals and asbestos analysis is presented in Table 2-4.

Table 2-4. Composite Samples Of Grinder Output Debris For Tclp Metals Analysis And Asbestos Analysis

Sample Type	Number of Samples	Total Samples
TCLP Metals		
Grinder Output	2	2
Asbestos		
Grinder Output	2	2

2.4.8.3 Water (Asbestos)

2.4.8.3.1 Water for Debris Wetting

Samples of the water containing a surfactant that will be used to wet the debris during handling and grinding activities will be collected for asbestos analysis. Each truck of water will be sampled. The expected number of samples that will be collected and analyzed for asbestos presented in Table 2-5.

Table 2-5. Samples Of Debris Wetting Water For Asbestos Analysis

Sample Type	Number of Samples
Water - 1 Sample per Truck	2
Field Blank	1
Total Samples	3

2.4.8.3.2 Surface Water

Samples of pooled surface water (if present) will be collected during application of the water to the debris pile and from beneath the grinder hopper. One composite sample will be collected from each of the areas. Grab samples will be collected during the 3rd and 6th hour (or as the site conditions suggest during the test) of the test run from each area and composited to yield one sample from each area. The expected number of surface water samples that will be collected and analyzed for asbestos is presented in Table 2-6.

Table 2-6. Surface Water Samples (Asbestos)

Sample Type	Number of Samples
Surface Water	2
Field Blank	1
Totals	3

2.4.8.4 Volume Reduction and Time Requirement

An estimate of the volume reduction achieved by the grinding process will be obtained by tallying the truckloads of debris by volume (each burrito wrap) delivered to the site and used during the test with the volume leaving the site laden with the ground debris. The volume of the debris entering and leaving the site will be estimated by URG. Berger is responsible for determining the volume fed to the grinder. The production rate (time requirement) will be estimated by dividing the estimated mass of debris ground by the time of production operation of the grinder.

2.4.8.5 Meteorological Monitoring

Meteorological conditions will be determined and continuously monitored during sampling using a Meteorological Monitoring System. The meteorological parameters that will be measured include wind direction and speed, air temperature, relative humidity, and barometric pressure. EPA will compile a video and photographic record of the testing.

2.4.8.6 Weather Restrictions

Monitoring will not be conducted during rain conditions. Should light rain be encountered, monitoring will cease until the rain stops. For this study, if sustained wind speeds in excess of 20 mph (60-minute average) are encountered, or winds in excess of 3 mph blowing directly East, the monitoring will be paused until the wind speed is less than these conditions. The maximum limits were established to attempt to prevent the higher winds speeds from excessively modifying the micrometeorology. Operations will resume upon the winds returning to a stable condition for 15-minutes minimum allowable within the confines of the test, or will be delayed until satisfactory conditions exist. Wind conditions at the site will be continuously monitored by the onsite weather station.

As an additional safety precaution, the test cannot be conducted when the wind direction is blowing toward the occupied trailers at the front of the Paris Road Landfill. Should this condition occur for longer than a 15-min period, the test will be halted until acceptable wind directions are re-established.

2.4.8.7 Summary of Field Samples

The anticipated number of field samples that will be collected is summarized in Table 2-7.

Table 2-7. Summary Of Field Samples To Be Collected (including QA Samples[a])

Source Table or QAPP	Air			Settled Dust	Grinder Output		Water
	Asbestos[c]	TSP/ Metals	PM_{10}	Asbestos	TCLP Metals	Asbestos	Asbestos
Table 2.1 Perimeter Air	75[b]	18	18	-	-	-	-
Table 2.2 Settled Dust	-	-	-	52	-	-	-
Table 2.3 Worker Air	8	8[d]	-	-	-	-	-
Table 2.4: Grinder Debris	-	-	-	-	2	2	-
Tables 2.5 & 2.6: Water	-	-	-	-	-	-	6
Total Samples	**83**	**26**	**18**	**52**	**2**	**2**	**6**

[a] Samples include field blanks and duplicate (co-located) samples.
[b] Twenty-one of these samples are low volume (960 liters) samples and will only be analyzed if high volume samples are overloaded.
[c] Samples will be analyzed both for asbestos (ISO 10312:1995) and total fibers (NIOSH 7400, A Rules).
[d] Lead only.

2.5 Personnel

The key project personnel are identified in the project organization chart presented in Figure 1-1.

2.6 Project Schedule

The project schedule is shown in Table 2-8 and commences with Contract Award and will be completed with submission of the final report. The project schedule below shows the major tasks, duration, and deliverables. Day 1 is December 8, 2007. If conditions permit, this effort may be accelerated as appropriate.

Table 2-8. Schedule

Task Description	Start	Finish	Duration
Begin Contract	Day 1	Day 1	1 Day
QAPP	Day 1	Day 120	120 Days
Debris Management	Day 120	210 Day	90 Days
Site Preparation	Day 120	Day 180	60 Days
Sampling	Day 180	Day 240	60 Days
Analysis	Day 240	Day 300	60 Days
Data Validation	Day 300	Day 330	30 Days
Draft Report	Day 270	Day 360	90 Days
Final Report	Day 390	Day 450	90 Days

SECTION 3 QUALITY OBJECTIVES AND CRITERIA FOR MEASUREMENT DATA

The overall quality assurance objective of this project is to implement procedures for field sampling, laboratory analysis, and reporting that will provide data for the development of scientifically valid conclusions and support decision making regarding the project objectives identified in Section 2.3. EPA has developed a seven-step Data Quality Objective (DQO) procedure designed to ensure that data collection plans are carefully thought out and to maximize the probability that the results of the project will be adequate to support decision-making (EPA QA/G-4, August 2000, EPA/600/R-96/055). This seven-step decision process has been applied to the Primary Project Objective.

3.1 Primary Objective

To determine the ***airborne asbestos (TEM) concentrations*** *released from the grinder operation.*

3.1.1 Step 1: State the Problem

EPA's OECA will issue a *No Action Assurance* letter to Region 6 that allows the EPA to proceed with the evaluation of the grinding of asbestos-containing residential building debris. EPA's ORD, in concert with OECA and Region 6, will perform a pilot test to determine if asbestos is released from the grinder operation (the handling and grinding of asbestos-containing residential building debris) and if so, to quantify the release. The grinding operation is a means of volume reduction of the debris.

3.1.2 Step 2: Identify the Decision

Has a release of asbestos occurred as a result of the grinder operation? If so, did the release cause environmental contamination that is large enough to be of potential human health concern?

3.1.3 Step 3: Identify Inputs to the Decision

Information that is required to resolve the decision statement:

1. Accurate and representative measurements of airborne asbestos concentrations released from the grinder operation.

2. An analytical sensitivity that is sufficiently low to detect with high confidence any airborne concentration that would be of potential inhalation concern for short-term exposure of an off-site resident to airborne releases. All perimeter air samples will be analyzed using TEM (ISO 10312:1995, all structures with aspect ratio $\geq$3:1) with an analytical sensitivity of 0.0005 asbestos structures per cubic meter (s/cm^3) of air sampled.

3. Accurate and representative measurements of the wind speed and wind direction during operation of the grinder operation.

3.1.4 Step 4: Define the Study Boundaries

1. *Spatial boundary of the decision statement*: This decision related to the air concentration of asbestos is defined as the area within the outermost ring around the grinder operation. The outermost ring is approximately 200-300 feet from the center of the grinder operation. Further, decisions regarding the air matrix apply to air within the breathing zone of potentially exposed individuals directly engaged in the grinder operation; e.g., excavator operator. The personal samples will allow reliable characterization of asbestos concentrations in air closest to the source of any potential releases.

2. *Temporal boundary of the decision statement*: Rain conditions may influence the transport and deposition of asbestos fibers released from the grinder operation. Sustained wind speeds of 15 mph (60-minute average) or gusts above 20 mph may affect the transport and dispersion of asbestos fibers; i.e., the asbestos concentration would be inversely proportional to the wind speed. The study will not be conducted during rain conditions, nor during wind conditions in excess of above.

3. *Practical constraints on data collection:*

    - Loading of particulate on a single sample filter collected over the grinder operation cycle could prevent the direct preparation of the filters for asbestos analysis by TEM.[3] To minimize the probability of such an occurrence, the sample flow rate will be set to achieve an acceptable air volume sample over the period of operation. In addition, co-located samples will be collected at lower flow rate (e.g., two lpm) at Ring 1.

    - In Ring 1, the number and placement of stationary air monitors could be affected by debris handling activities. This is particularly applicable on the side of the grinder where the excavator is located and debris loading activities will occur.

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[3] The direct transfer TEM method (ISO 10312:1995) should not be used if the general particulate loading of the sample collection filter exceeds approximately 10 μg/cm^2 of filter surface, which corresponds to approximately 20 percent coverage of the collection filter by particulate.

3.1.5 Step 5: Develop a Decision Rule

If the airborne concentration of asbestos in the particulate released from the grinder operation does not result in exposure concentrations that are of potential human health concern, then it may be concluded that the grinder operation as evaluated does not pose an unacceptable human health concern and could be used as a means of reducing the volume of waste requiring disposal.

3.1.6 Step 6: Tolerable Limits on Decision Errors

The 95-percent confidence interval for the mean number of fibers from a count is shown in the Table 3-1. These values indicate the range of counts that are expected to be observed from identical filters based upon random selection of grids 95 times out of 100 times.

Table 3-1. Upper and Lower Confidence Limits of The Poisson 95-Percent Confidence Interval of a Count[a]

Structure Count	Lower 95- Percent Confidence Limit[b]	Upper 95 Percent Confidence Limit[b]
0	0	3.689
1	0.025	5.572
2	0.242	7.225
3	0.619	8.767
4	1.090	10.242
5	1.624	11.669
6	2.202	13.060

[a] Source: ISO Method 10312:1995(E) Annex F, Table F.1.
[b] Two-tailed confidence interval.

ISO Method 10312:1995(E) defines the analytical sensitivity as the calculated airborne asbestos structure concentration in asbestos structure/liter, equivalent to counting of one asbestos structure in the analysis. The limit of detection is defined as the calculated airborne asbestos structure concentration per liter equivalent to counting 2.99 asbestos structures in the analysis. Annex F of ISO 10312:1995(E) indicates that the level of detection is 2.99 times the analytical sensitivity, which corresponds with the one-sided 95 percent upper confidence interval of the Poisson distribution. As such, fiber counts below three, which is the two-tailed 95-percent upper confidence interval for a count of zero, could be treated as non-detects. In the event the number of non-detects in this demonstration is greater than 80% in either group, the data will be analyzed using a binomial test for proportions. The binomial test will be used to evaluate the null hypothesis that the proportion of non-detects from the two populations (background and grinder) are equivalent.

A suite of background comparison tests for dealing with a set of data with a large number of non-detect (censored) data, originally developed in the early 1990s by Dr. Richard Gilbert at Pacific Northwest National Laboratory, will be used to compare the grinder and background data distributions. Each test compares a somewhat different (although correlated) characteristic of the demolition and background data distributions. For each test, if the p-value is small enough (e.g. less than a significance level of 0.05) the null hypothesis is rejected, and the conclusion is drawn that the grinder data are greater than the background in the context of the characteristic tested. If the p-value is much greater than 0.05 then the grinder and background data distributions are considered similar, or the background data are greater than grinder data, which might instead indicate a comparability problem with the background data set.

The background comparison suite of inferential tests, t, Gehan, Quantile Q(.80) and Slippage, consists of a single parametric and three non-parametric tests. A parametric test makes assumptions about the underlying distributions, whereas a non-parametric test does not. Distributions are uniquely characterized by parameters (e.g. mean and standard deviation) and hence the name "parametric test." For example, the t-test, which quantifies the observed difference between the means of two distributions, is a parametric test that requires the assumption of normality. The results of the t-test are relatively robust to departures from normality; however for extremely skewed or bimodal distributions, the results of the t-test may be suspect. The non-parametric analog of the t-test is the Gehan test, a generalization of the Wilcoxon Rank Sum test that accommodates multiple detection limits through an ordering algorithm. The Gehan test quantifies the degree of difference between the medians of two distributions. As a non-parametric test, the Gehan test is less prone to the effects of very extreme data. Statistical tests that evaluate normality (e.g. D'Agostino & Pearson) will be used to determine the appropriateness of applying the t-test.

Two additional non-parametric tests will be used to assess differences that may exist in the tails of the two distributions. Specifically, the Quantile test is used here to determine if there are an anomalously large number of grinder data that exceed the 80th percentile of the background distribution. This test is performed using combinatorial counting techniques under the assumption that both the grinder and background data arise from the same underlying distribution. If there are an anomalously large number of grinder data greater than the 80th percentile of the background distribution, then it is concluded that, with respect to statistical significance, the 80th percentile of the grinder data distribution is greater than the 80th percentile of the background data distribution. Effectively this means the tail of the grinder distribution is "fatter" than that of the background distribution; therefore there is a statistical difference in the tails of the distributions. The Slippage test will be used to see if there are an anomalously large number of grinder data that exceed the maximum of the background data. This test is similar in function to the Quantile test. If there are an anomalously large number of demolition data greater than the maximum of the background data, then it is concluded that, with respect to statistical significance, the maximum data of the grinder distribution are greater than the maximum of the background distributions.

If any of the p-values from the four hypothesis tests are less than the nominal alpha level of 0.05, the conclusion from that test will be used for the overall result. The t-test will be included only if the assumptions of normality and homogeneity of variance are met. If these assumptions are not met, the conclusion for the overall result will be based on the three nonparametric inferential tests.

In addition, exploratory data analysis plots such as box plots, histograms, q-q plots and cumulative distribution plots, will be used as qualitative assessment of the form of the distributions for both grinder and background data. Displays meet the need to see the behavior of the data, to reveal unexpected features, such as outliers; and confirm or disprove assumptions, such as the distributional assumptions of normality and homogeneity of variance required for the t-test. In the event an observation(s) is outside the main body of the data, records will be reviewed for an assignable cause(s) and the data value(s) corrected if appropriate. Even if there is no assignable cause(s), the value(s) will be included in all analyses and appropriate measures will taken to meet inferential test assumptions if necessary (i.e., data transformation to meet normality or homogeneity of variance assumptions).

Upwind to Downwind Comparison— If the meteorological conditions permit an upwind to downwind comparison, the project is designed to detect a five-fold difference in the average concentration of asbestos (e.g., a five-fold difference between the airborne concentrations upwind and downwind from the grinder operation) with high probability if such a difference actually exists. A false positive error rate of five percent will be achieved by employing a statistical significance level of 0.05. The statistical power of the upwind to downwind comparison will depend on the number of the 18 samples in Ring 1 and Ring 2 that are actually in downwind of grinder operation. An alternative to strictly upwind/downwind is to weight each sampler concentration by the number of minutes during the sampling that that individual sampler was upwind or downwind and performing statistical comparisons on those weighted data.

Sample size estimates for mean comparisons for the variables:

coefficient of variation (CV) = 1.00, 1.50, 2.00, and 2.50 (CV = standard deviation/mean where the CV is the same for both populations),
type I error rate = 0.05,
mean difference = 5-fold and 10-fold (CR = (downwind-upwind)/downwind), and
power = 0.80, 0.85, and 0.90;
are displayed in (Table 3.2). The estimates were calculated using the equation,

$$n = \frac{[z_{(1-a/2)} + z_{(1-\beta)}]^2 (CV)^2}{(CR)^2} [1 + (1 - CR)^2],$$

where z is the quantile of the standard normal distribution (van Belle, G. and Martin, D. (1993). Sample size as a function of variation and ratio of means. The American Statistician, 47: 165-167).

Table 3-2. Sample Estimates Required for Each Sample in a Two-Sample t-Test with Type I error = 0.05.

Ten-fold Mean Difference				
Power	Percent Coefficient of Variation			
	100	150	200	250
0.80	10	22	40	62
0.85	11	25	45	70
0.90	14	31	55	86
Five-fold Mean Difference				
Power	Percent Coefficient of Variation			
	100	150	200	250
0.80	13	29	52	81
0.85	15	33	58	91
0.90	18	40	71	112

3.1.7 Step 7: Optimize the Design for Obtaining Results

The most important factor influencing the airborne asbestos concentration measured at one of the 18 primary monitors (i.e., Ring 1) to be positioned around the grinder operation is the number of hours that monitor is downwind from the activity. Because the wind direction could vary (i.e., change directions) during a given test day, it was concluded that the primary air sampling design should be based on a concentric ring approach rather than on an upwind to downwind approach.

3.1.8 Analytical Sensitivity

The data generated for this project must be obtained with an analytical sensitivity sufficiently low to detect with high confidence any airborne concentration that would be of potential inhalation concern for short-term exposure of an off-site resident to airborne releases. The analytical sensitivity will be 0.0005 s/cm^3 for all asbestos structures (minimum length $\geq$0.5 µm and aspect ratio $\geq$3:1).

Achieving the analytical sensitivity for asbestos in air samples is generally dependent on two factors: the volume of air collected through the filter and the area of the filter analyzed; i.e., the number of grid sections analyzed multiplied by the area of the grid sections analyzed. The required analytical sensitivity will be achieved for each collected air sample by collecting as large a volume of air as practical and by increasing the filter search areas, as needed.

3.1.9 Data Quality Indicators (DQI)

3.1.9.1 Sample Collection DQI

- Precision is the agreement between the measurements collected by two identical devices or measures. Precision is reported as relative percent difference (RPD) between duplicate samples or sample analyses. Precision will be measured by collecting duplicate samples during the sampling events. Duplicate "co-located" samples will be collected during each of the sampling events. These samples will also serve as a combined check on the sample collection and analysis procedures.

$$\frac{|Result\ 1 - Result\ 2|}{Mean} \times 100$$

- Completeness is defined as follows:

$$\%Completeness = \frac{V}{N} x100$$

  where V is the number of measurements judged valid, and N is the number of measurements planned. An overall measure of completeness will be given by the percentage of samples specified in the sampling design that yield usable "valid" data. Although every effort will be made to collect and analyze all of the samples specified in the sample design, the sample design is robust to sample loss. The loss of a few samples, provided they are not concentrated at a set of contiguous sectors, will likely have little effect on the false-negative error rate. The project goal is to collect at least 95 percent of the samples specified in the sample design.

- Representativeness is a subjective measure of the degree that the data accurately and precisely represent the sample collection conditions of the environment. Representative sample collection depends on the expertise and knowledge of the personnel to make sure the samples are collected in a manner that reflects the true concentration in the environment. The sampling locations, sampling periods, and sampling durations have been selected to ensure reasonable representativeness.

- Comparability is a qualitative term that expresses the measure of confidence that one data set can be compared to another and combined for the decision to be made. Data collection using a standard sampling and analytical method (e.g., ISO 10312:1995, counting structures longer than and shorter than five µm in length, and PCM equivalent fibers[4]) maximizes the comparability of the results with both past sampling results (if such exist) and future sampling results.

[4] A PCM (phase contrast microscopy) equivalent fiber (PCME) is a fiber with an aspect ratio greater than or equal to 3:1, longer than 5 µm, and which has a diameter greater than 0.25 µm.

3.1.9.2 Sample Analysis DQI

Analysis of identical image fields as measured by the principal analytical laboratory and the QC laboratory will determine the precision DQI. Precision in number of asbestos fibers and asbestos fiber dimensions from the same filters and image fields from selected tests will be measured. Filters loaded with asbestos collected by air filtration have an inherent variability that is exacerbated by the exceedingly small area analyzed by TEM. Although the variability cannot be mitigated by sampling strategies or sampling preparation strategies, it can be quantified; if factors exist that are artificially magnifying the variability, those factors can in theory be isolated and identified. The best approach to this is through inter-laboratory re-preparation and re-analysis of filters and intra-laboratory re-preparation and re-analysis of filters. Inter-laboratory re-analysis establishes that the variability is not caused by the laboratory's sample preparation and analytical techniques. If the laboratory was improperly preparing the samples and was causing the results to consistently bias high or low, then the second laboratory's analysis of numerous samples should reveal this trend. If the samples had exceedingly high variability across the filter (or if the laboratory was causing artificial variability through sample preparation and analysis techniques), then this would be revealed by re-preparation and analysis of the filter by the same laboratory. It is essential to note that the variability determined may seem subjectively high (compared to other types of instrumental analysis) when in fact it may be quite acceptable because very small sub-samples of the original filter are being examined.

Because no standards are available to assess the accuracy of the TEM measurements, the best approach is to establish consensus standards through duplicate analysis of precise sub-samples. This is accomplished through a procedure called "verified counting," which is documented in a National Institute of Standards and Technology (NIST) technical guide and used by asbestos analytical laboratories. Two laboratories (in this case the primary analytical laboratory and the QA laboratory) analyze precise identical areas of the sampling filter, and compare their results, which consist of numbers of asbestos structures and drawings and dimensions of each asbestos structure. In this fashion, they can mutually agree on the concentration of asbestos in the sub-sample, and can verify that each is following the very specific guidelines for asbestos structure counting by TEM. Any lack of precision or presence of bias can be readily established and quantified. See SECTION 10 regarding the QA/QC criteria for the analytical method DQI.

SECTION 4 SPECIAL TRAINING REQUIREMENTS/CERTIFICATION

4.1 Field Personnel

The field sampling team will be headed by an engineer or scientist with acceptable experience in the collection, handling, and analyses of samples required in this effort. The field sampling team leader has extensive experience in conducting asbestos-related field research studies. Other field personnel will also have experience in asbestos ambient air monitoring, occupational exposure monitoring, related environmental measurements, and data recording. The field personnel will be trained in the requirements of the site-specific Health and Safety Plan (HASP).

4.2 Laboratory Personnel

The laboratories and appropriate contacts are given in Table 4-1.

Table 4-1. Laboratories And Contacts

Primary Laboratories	
Schneider Labs, Inc 2512 W. Cary Street Richmond Va 23220 Contact: Melissa Kanode 804-353-6778 PM_{10}, TSP, Metals, TCLP	Bureau Veritas North America, Inc. 3380 Chastain Meadows Parkway, Suite 300 Kennesaw, GA 30144 Contact: Alan M. Segrave, P.G. (770) 499-7500 Asbestos: Bulk, Settled Dust, Air, Water Lead: Paint Chips
Quality Assurance Laboratory	
Reservoirs Environmental, Inc. 2059 Bryant Street Denver, CO 80211 Contact: Jeanne Spencer Orr (330) 964-1986 Asbestos Air	

SECTION 5 DOCUMENTATION AND RECORDS

5.1 Field Operations Records

5.1.1 Sample Documentation

The following information will be recorded on Sampling Data Forms (Figure 5-1through Figure 5-10), as applicable:

- Name(s) of person(s) collecting the sample
- Date of record
- Identification of sampling site (e.g., Ring 1)
- Description of sample including a photographic image with the sample number
- Location of sample documented on site map with GPS coordinates, as applicable
- Type of sample (e.g., area, personal, settled dust, duplicate, field blank)
- Unique sample number that identifies site, sample type, date, and sequence number
- Airflow reading (start/stop)
- Sample time (start/stop) recorded in military time
- Relevant notes describing site observations such as, but not limited to, site conditions, weather conditions, debris handling equipment, observations of visible emissions from the grinder operation, equipment problems, etc.

At the end of each day, all samples and the corresponding Sampling Data Forms/Drawings will be submitted to the Team Leader. The Team Leader will verify 100% of the information recorded on the Sampling Data Form for completeness and that all samples are in custody; any discrepancy will be resolved and corrections will be noted and initialed on the form.

5.1.2 Meteorological Measurements

Meteorological stations will record temperature, barometric pressure, relative humidity, wind speed, and wind direction at five-minute averages. The data files will be downloaded by using an on-site personal computer. These same metrics will also be noted from the instrument's visual display and recorded on a Meteorologic Data Measurement Log (Figure 5-8) at least hourly.

THE LOUIS BERGER GROUP, INC.

ASBESTOS AIR SAMPLE LOG/CHAIN OF CUSTODY PAGE 1 OF 1

PROJ. NO.:		DATE:	
CLIENT:	EPA	TECHNICIAN:	
SITE:		PROJ. MANAGER:	Seth Schultz

THE LOUIS BERGER GROUP, INC. TELEPHONE # : (212) 612-7900 **FAX #: (212) 425-1618** ADDRESS: 199 Water Street 23rd Floor, New York, NY 10038	RESULTS FAX TO: EMAIL TO: cnapolitano@louisberger.com EMAIL TO: Schultz@louisberger.com	TURNAROUND TIME: ☐ 1 HR ☐ 4 HR ☐ 8 HR ☐ 24 HR ☒ ISO 10312 TAT

SAMPLE ID	DESCRIPTION / LOCATION	TIME START/END	TIME MINUTES	FLOW RATE (L/MIN) START/END	FLOW RATE (L/MIN) AVERAGE	VOLUME (L)
SAMPLE # PUMP # N/A						
SAMPLE # PUMP # N/A						
SAMPLE # PUMP # N/A						
SAMPLE # PUMP # N/A						
SAMPLE # PUMP # N/A						
SAMPLE # PUMP # N/A						
SAMPLE # PUMP #						
SAMPLE # PUMP #						

TECHNICIAN'S LOG

CASSETTE	ROTOMETER		TYPE OF SAMPLING		
☐ PCM ☐ TEM	ID #:	CALIB. DATE:_____/_____/_____	☐ BACKGROUND	☐ POST ABATEMENT	☐ PERIODIC
☐ __________	[ALL GIVEN FLOW RATES INCORPORATE THE CALIBRATION FACTOR]		☐ PRE-ABATEMENT	☐ AMBIENT	☐ LOT BLANK
			☐ DURING ABATEMENT	☐ OSHA	

CHAIN OF CUSTODY		DATE	TIME
Relinquished by (print)	(Sign)	/ /	Am/Pm
Received by (print)	(Sign)	/ /	Am/Pm
Relinquished by (print)	(Sign)	/ /	Am/Pm
Received by (print)	(Sign)	/ /	Am/Pm
Relinquished by (print)	(Sign)	/ /	Am/Pm
Received by (print)	(Sign)	/ /	Am/Pm

NOTES/COMMENTS

Figure 5-1. Stationary air monitor sampling form.

The Louis Berger Group, Inc.
199 Water Street, 23rd Floor
New York, New York10038
Tel 212 612 7900
Fax 212 363 1618

AIR SAMPLING FIELD LOG			
SAMPLE NUMBER		TIME ON:	
		TIME OFF:	
DATE		GPS COORDINATES	
FLOW		SAMPLE HEIGHT	
SAMPLING SESSION		PUMP NUMBER	

TIME	FLOW	NOTES
900	2.02	
1100	2.12	Change less than 10%
1300	2.35/2.02*	Change greater than 10% sample adjusted back to 2.02

NOTES: All sample time must be in milatary time
If sample flow is greater than 10% adjustment must be made back to orignally intended vol.
Rotometer correction factor MUST be applied in the field
Sample flow will be checked every 2 HOURS

Inspector's Signature:___________________________

Figure 5-2. Stationary air monitor sampling form (continued).

Louis Berger Group

LABORATORY CHAIN OF CUSTODY

WORK LOCATION:

Check Activity Associated with Air Monitoring

☐ Grinding ☐ Background Air Sampling ☐ (Other) Describe ________________

Wind Direction/Speed (MPH)		Temperature (Fahrenheit)		Barometric Pressure (mm Hg)	
AM	PM	AM	PM	AM	PM

SAMPLING DATE:

SAMPLE Date/Unit No.	FILTER NUMBER	SERIAL #	LOCATION	START TIME	STOP TIME	WATER COLUMN START	WATER COLUMN END
-PM10-1							
-PM10-2							
-PM10-3							
-PM10-4							
-FB	Field Blank						

NOTE: Submit Field Blank Every 10th Day of Air Monitoring

Analysis:

PM-10________ TSP-Lead _________

FAX Results with Chain-Of-Custody To: Rhine Almonacy 212-363-4341
COMMENTS: SAMPLE DATE (mm/dd/yr) IS PREFIX FOR EACH SAMPLE NUMBER

RELINQUISHED BY:________________________________ DATE:___/___/ 2008

RECEIVED BY:________________________________ DATE:___/___/ 2008

RELINQUISHED BY:________________________________ DATE:___/___/ 2008

RECEIVED BY:________________________________ DATE:___/___/ 2008

Figure 5-3. Air sampling data form for PM and TSP.

THE LOUIS BERGER GROUP, INC.	ASBESTOS AIR/CHAIN OF CUSTODY-OSHA-Worker	PAGE 1 OF 1

PROJ. NO.:		DATE:	
CLIENT:	EPA	TECHNICIAN:	
SITE:		PROJ. MANAGER:	Seth Schultz

THE LOUIS BERGER GROUP, INC. TELEPHONE # : (212) 612-7900 FAX #: (212) 425-1618 ADDRESS: 199 Water Street 23rd Floor, New York, NY 10038	RESULTS FAX TO: EMAIL TO: cnapolitano@louisberger.com EMAIL TO: Schultz@louisberger.com	TURNAROUND TIME: ☐ 1 HR ☐ 4 HR ☐ 8 HR ☐ 24 HR ☒ ISO 10312 TAT

SAMPLE ID	DESCRIPTION / LOCATION	TIME START/END	TIME MINUTES	FLOW RATE (L/MIN) START/END	FLOW RATE (L/MIN) AVERAGE	VOLUME (L)
SAMPLE # PUMP # N/A						
SAMPLE # PUMP # N/A						
SAMPLE # PUMP # N/A						
SAMPLE # PUMP # N/A						
SAMPLE # PUMP # N/A						
SAMPLE # PUMP # N/A						
SAMPLE # PUMP #						
SAMPLE # PUMP #						

TECHNICIAN'S LOG

CASSETTE	ROTOMETER		TYPE OF SAMPLING		
☐ PCM ☐ TEM	ID #:	CALIB. DATE:____/____/____	☐ BACKGROUND	☐ POST ABATEMENT	☐ PERIODIC
☐ ________	[ALL GIVEN FLOW RATES INCORPORATE THE CALIBRATION FACTOR]		☐ PRE-ABATEMENT	☐ AMBIENT	☐ LOT BLANK
			☐ DURING ABATEMENT	☐ OSHA	

CHAIN OF CUSTODY		DATE	TIME
Relinquished by (print)	(Sign)	/ /	Am/Pm
Received by (print)	(Sign)	/ /	Am/Pm
Relinquished by (print)	(Sign)	/ /	Am/Pm
Received by (print)	(Sign)	/ /	Am/Pm
Relinquished by (print)	(Sign)	/ /	Am/Pm
Received by (print)	(Sign)	/ /	Am/Pm

NOTES/COMMENTS

Figure 5-4. Air sampling data form for worker monitoring.

THE Louis Berger Group, INC.
199 Water Street, 23rd Floor New York, NY 10038 USA
Tel 212 612 7900 Fax 212 363 4341 Website www.louisberger.com

DAILY INSPECTION LOG

CLIENT:			PROJECT MANAGER:		
SITE :			PAGE ______ OF ______		
INSPECTOR:		SIGNATURE:		DATE:	
CONTRACTOR:					
Type of Work being performed:					

TIME (Military)	CONSTRUCTION ACTIVITIES (Narrative Description of Activities)

Figure 5-5. Site daily log form.

THE Louis Berger Group, INC.
199 Water Street, 23rd Floor New York, NY 10038 USA
Tel 212 612 7900 Fax 212 363 4341 Website www.louisberger.com

CONTRACTOR WORKERS/ VISITORS LOG ***DATE __________***

CLIENT:		PROJECT MANAGER:
SITE :		PAGE _____ OF _____
CONTRACTOR:		
Type of Work Performed:		

	NAME	TITLE (Circle one)	CERTIFICATE & LICENSE Louisiana Cert #		LICENSE EXPIRATION DATE	MISC. EXPIRATION DATE	TYPE OF RESP.
		SUPERVISOR HANDLER					1 2 3 4 5
		SUPERVISOR HANDLER					1 2 3 4 5
		SUPERVISOR HANDLER					1 2 3 4 5
		SUPERVISOR HANDLER					1 2 3 4 5
		SUPERVISOR HANDLER					1 2 3 4 5
		SUPERVISOR HANDLER					1 2 3 4 5
		SUPERVISOR HANDLER					1 2 3 4 5
		SUPERVISOR HANDLER					1 2 3 4 5
		SUPERVISOR HANDLER					1 2 3 4 5
		SUPERVISOR HANDLER					1 2 3 4 5

Notes:

Key:
1. Half Face Resp.
2. Full Face Respirator
3. PAPR
4. Type "C" Respirator
5. Type C Supplied Air

Figure 5-6. Site visitors/contractors log form.

THE LOUIS BERGER GROUP, INC.	ASBESTOS SETTLED DUST CHAIN OF CUSTODY	PAGE OF

PROJ. NO.:		DATE:	
CLIENT:	EPA	TECHNICIAN:	
SITE:		PROJ. MANAGER:	Seth Schultz

THE LOUIS BERGER GROUP, INC. TELEPHONE # : (212) 612-7900 **FAX #: (212) 425-1618** ADDRESS: 199 Water Street 23rd Floor, New York, NY 10038	RESULTS FAX TO: EMAIL TO: cnapolitano@louisberger.com EMAIL TO: sschultz@louisberger.com	TURNAROUND TIME: ☐ 1 HR ☐ 4 HR ☐ 8 HR ☐ 24 HR ☒ OTHER

SAMPLE ID	DESCRIPTION / LOCATION	TIME START/END	TIME START/END	TIME START/END	TIME TOTAL MIN.	TOTAL AREA
SAMPLE #						
SAMPLE #						
SAMPLE #						
SAMPLE #						
SAMPLE #						
SAMPLE #						
SAMPLE #						
SAMPLE #						

TECHNICIAN'S LOG

CASSETTE	ROTOMETER		TYPE OF SAMPLING		
☐ PCM ☐ TEM	ID #:	CALIB. DATE:_____/_____/_____	☐ BACKGROUND	☐ POST ABATEMENT	☐ PERIODIC
☒ OTHER	[ALL GIVEN FLOW RATES INCORPORATE THE CALIBRATION FACTOR]		☐ PRE-ABATEMENT	☐ AMBIENT	☐ LOT BLANK
			☐ DURING ABATEMENT	☐ OSHA	

CHAIN OF CUSTODY		DATE	TIME
Relinquished by (print)	(Sign)	/ /	Am/Pm
Received by (print)	(Sign)	/ /	Am/Pm
Relinquished by (print)	(Sign)	/ /	Am/Pm
Received by (print)	(Sign)	/ /	Am/Pm
Relinquished by (print)	(Sign)	/ /	Am/Pm
Received by (print)	(Sign)	/ /	Am/Pm

NOTES/COMMENTS

Only Analyze as per QAPP. Modified ASTM 05755-03 Settled Dust. Target Analytical Sensitivity 250 s/cm2. All structures (minimum length of 0.5 um; aspect ratio greater than or equal to 3:1).

Stopping rule: see page 65 of QAPP.. Total time listed for reference only, not needed for sample analysis.

Figure 5-7. Settled dust sampling form.

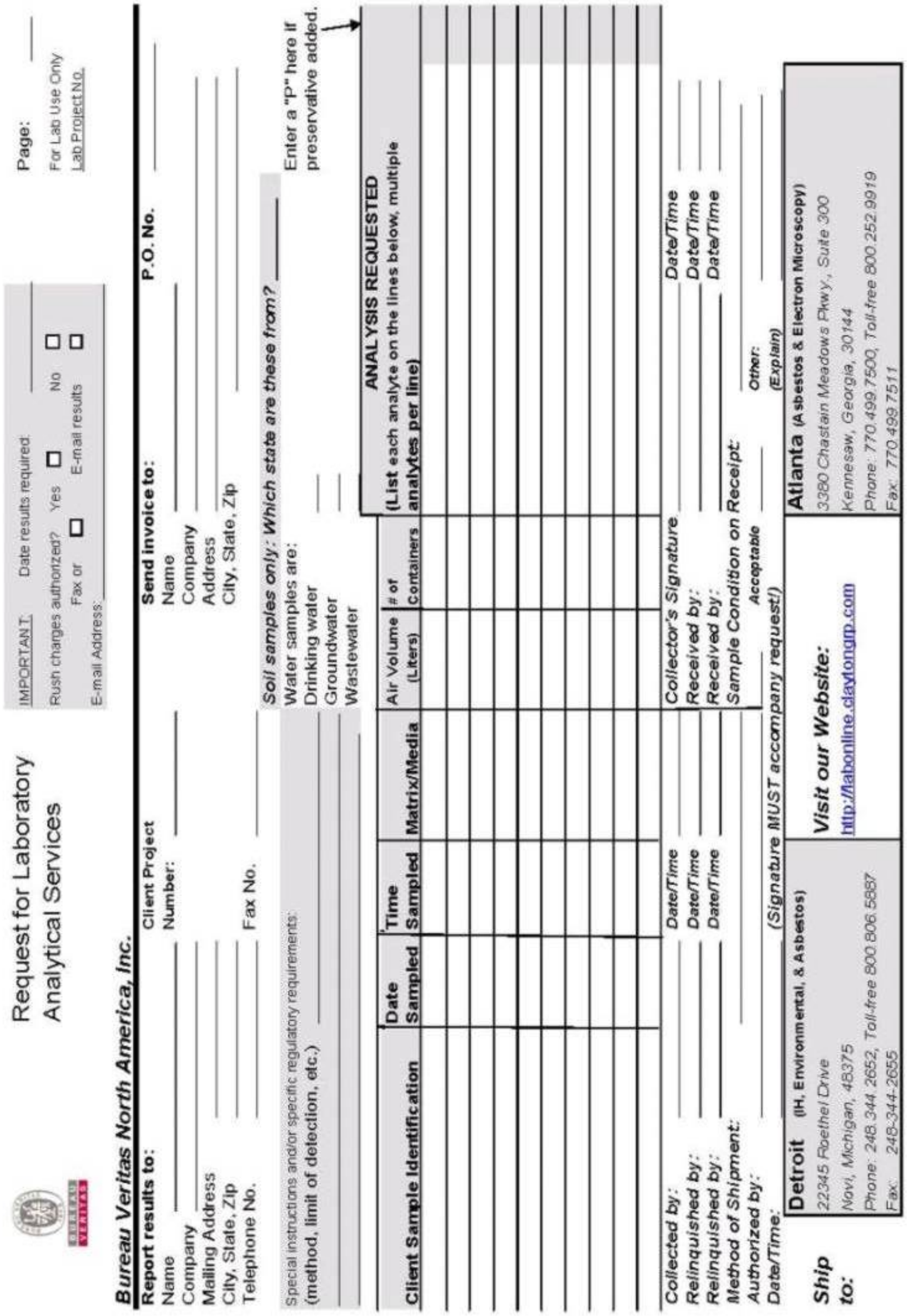
Weather Station Measurement Log

(Use of form is optional- Information must be in bound notebook)

Date: _______________		**Page _______ of _______**

Time	**Wind Speed MPH**	**Wind Direction**	**Barometric Pressure, in Hg**	**Temperature ^{0}F**	**Relative Humidity %**	**Entries By**

Figure 5-8. Meteorogical log form.



Request for Laboratory Analytical Services

IMPORTANT: Date results required: ____
Rush charges authorized? Yes ☐ No ☐
Fax or ☐ E-mail results ☐
E-mail Address: ____

Page: ____
For Lab Use Only
Lab Project No.

Bureau Veritas North America, Inc.

Report results to:
Name ____
Company ____
Mailing Address ____
City, State, Zip ____
Telephone No. ____

Client Project Number: ____
Fax No. ____

Send invoice to:
Name ____
Company ____
Address ____
City, State, Zip ____

P.O. No. ____

Special instructions and/or specific regulatory requirements:
(method, limit of detection, etc.) ____

Soil samples only: Which state are these from? ____
Water samples are:
Drinking water ____
Groundwater ____
Wastewater ____

Enter a "P" here if preservative added.

Client Sample Identification	Date Sampled	Time Sampled	Matrix/Media	Air Volume (Liters)	# of Containers	ANALYSIS REQUESTED (List each analyte on the lines below, multiple analytes per line)	

Collected by: ____ Date/Time ____
Relinquished by: ____ Date/Time ____
Relinquished by: ____ Date/Time ____
Method of Shipment: ____
Authorized by: ____
Date/Time: ____ (Signature MUST accompany request!)

Collector's Signature ____ Date/Time ____
Received by: ____ Date/Time ____
Received by: ____ Date/Time ____
Sample Condition on Receipt: ____
Acceptable ____ Other: ____ (Explain)

Ship to:

Detroit (IH, Environmental, & Asbestos)
22345 Roethel Drive
Novi, Michigan, 48375
Phone: 248.344.2652, Toll-free 800.806.5887
Fax: 248-344-2655

Visit our Website:
http://labonline.claytongrp.com

Atlanta (Asbestos & Electron Microscopy)
3380 Chastain Meadows Pkwy., Suite 300
Kennesaw, Georgia, 30144
Phone: 770.499.7500, Toll-free 800.252.9919
Fax: 770.499.7511

Figure 5-9. Water sampling log form.

THE LOUIS BERGER GROUP, INC.	**TSP/PM10 Sampling Form**	PAGE 1 OF 1

PROJ. NO.:		DATE:	
CLIENT:	EPA	TECHNICIAN:	
SITE:		PROJ. MANAGER:	Seth Schultz

THE LOUIS BERGER GROUP, INC. TELEPHONE # : (212) 612-7900 FAX #: (212) 425-1618 ADDRESS: 199 Water Street 23rd Floor, New York, NY 10038	RESULTS FAX TO: EMAIL TO: cnapolitano@louisberger.com EMAIL TO: Schultz@louisberger.com	TURNAROUND TIME: ☐ 1 HR ☐ 4 HR ☐ 8 HR ☐ 24 HR ☒ ISO 10312 TAT

SAMPLE ID	DESCRIPTION / LOCATION	TIME START/END	TIME MINUTES	FLOW RATE (L/MIN) START/END	FLOW RATE (L/MIN) AVERAGE	VOLUME (L)
SAMPLE # PUMP # N/A		/		/		
SAMPLE # PUMP # N/A		/		/		
SAMPLE # PUMP # N/A		/		/		
SAMPLE # PUMP # N/A		/		/		
SAMPLE # PUMP # N/A		/		/		
SAMPLE # PUMP # N/A		/		/		
SAMPLE # PUMP #		/		/		
SAMPLE # PUMP #		/		/		

TECHNICIAN'S LOG

CASSETTE	ROTOMETER		TYPE OF SAMPLING		
☐ PCM ☐ TEM	ID #:	CALIB. DATE:_____/_____/_____	☐ BACKGROUND	☐ POST ABATEMENT	☐ PERIODIC
☐ __________	[ALL GIVEN FLOW RATES INCORPORATE THE CALIBRATION FACTOR]		☐ PRE-ABATEMENT	☐ AMBIENT	☐ LOT BLANK
			☐ DURING ABATEMENT	☐ OSHA	

CHAIN OF CUSTODY		DATE	TIME
Relinquished by (print)	(Sign)	/ /	Am/Pm
Received by (print)	(Sign)	/ /	Am/Pm
Relinquished by (print)	(Sign)	/ /	Am/Pm
Received by (print)	(Sign)	/ /	Am/Pm
Relinquished by (print)	(Sign)	/ /	Am/Pm
Received by (print)	(Sign)	/ /	Am/Pm

NOTES/COMMENTS

Figure 5-10. TSP Sampling form.

5.1.3 Photo Documentation

Digital photographic images will be taken as necessary to thoroughly document the site conditions and activities.

5.2 Chain-of-Custody Records

Berger sample traceability procedures described in Section SECTION 10, *"Sample Custody Requirements,"* will be used to ensure sample traceability.

5.2.1 Laboratory Records

Complete data packages will be submitted for all sample analyses for all matrices. This information will be submitted in sufficient detail to allow the subsequent verification of the reported analyses. Alternative forms routinely used by the laboratories may be substituted for those forms specified in the referenced methods. The laboratory data package will meet the guidelines in *Laboratory Documentation Requirements for Data Evaluation* (R9/QA/004.2), EPA, August 2001.

5.2.2 TEM Reporting (Air)

Specifically for TEM analysis, the following is required:

- Structure counting data shall be recorded on forms equivalent to the example shown in ISO 10312:1995.

- The test report shall contain items (a) to (p) as specified in Section 10, "Test Report," of ISO 10312:1995. In addition, the files containing the raw data (in Microsoft Excel format) shall be submitted. The format of these files shall be as directed by the Project Manager, but shall contain the following items:

  1. Laboratory Sample Number
  2. Project Sample Number
  3. Date of Analysis
  4. Air Volume
  5. Active Area of Sample Filter
  6. Analytical Magnification
  7. Mean Grid Opening Dimension in mm^2
  8. Number of Grid Openings Examined
  9. Number of Primary Structures Detected
  10. One line of data for each structure, containing the following information as indicated in Figure 7 "Example of Format for Reporting Structure Counting Data" of ISO 10312:1995, with the exception that the lengths and widths are to be reported in millimeters as observed on the screen at

the counting magnification:

- Grid Opening Number
- Grid Identification
- Grid Opening Identification/Address
- Structure or Sub-structure Number
- Asbestos Type (Chrysotile or Amphibole)
- Morphological Type of Structure
- Length of Structure in 1-mm increments (e.g., 32)
- Width of Structure in 0.1-mm increments (e.g., 3.2)
- Any Other Comments Concerning Structure (e.g., partly obscured by grid bar)

SECTION 6 MEASUREMENT/DATA ACQUISITION

6.1 GRINDING OPERATIONS

6.1.1 Air Dispersion Modeling

This section presents the modeling approach used to assist in the placement of ambient air monitors that will be used to measure the concentration of airborne asbestos fibers during the grinding operations and associated debris handling activities. Results of modeling efforts conducted for a similar scenario (i.e., the loading of a truck bed with demolition debris) were used as a predictive tool to evaluate possible monitor placements in the vertical (z) plane. The modeling results used for this QAPP document were obtained from a similar study contained in the following U.S. EPA document titled: *Quality Assurance Project Plan, Evaluation of An Alternative Asbestos Control Method for Building Demolition, U.S. EPA Contract No. 68-C-00-186, Task Order No. 0019, November 23, 2005*.

6.1.2 Source Identification

The sources identified for purposes of evaluating this modeling consist primarily of operations associated with the grinding and debris handling activities taking place during this effort. The predominant activities include the transfer/loading of debris to the bed of a grinder as well as the transfer of ground material from the conveyor of the grinder to the ground and other miscellaneous material handling. These operations will likely be occurring simultaneously and have the potential to release dust and other airborne particulate matter to the atmosphere. For purposes of this modeling scenario, the modeling analysis from the QAPP referenced in Section 6.1.1 was used to account for these potential contributions of only the transfer/loading of debris to the grinder to aid in the determination of appropriate monitoring height placement for the ambient air monitors. However, associated fugitive source operations should also be included in subsequent modeling analyses to account for their potential contributions.

6.1.3 Source Description

An example of the type of equipment to be used as part of the grinding operations is shown in Figure 2-1. The grinding equipment consists of a rectangular bed where debris will be placed prior to grinding. A demolition grappler will be used to transfer the debris to the rectangular bed of the grinding equipment. Once the material passes through the grinder, the ground material is conveyed away from the grinder and drops from the top of the conveyor to a storage pile for later disposal. Potential emissions result from the transfer of the debris material into the bed of the grinder, transfer of the ground material from the conveyor to the storage pile, as well as other miscellaneous material handling activities.

Potential fugitive emissions were not explicitly modeled here, but were considered and based on other modeling studies conducted for similar types of fugitive source operations.

6.1.4 Model Selection

Model selection was based on other modeling conducted for the U.S. EPA QAPP referenced in Section 6.1.1. In that particular study, U.S. EPA's SCREEN3 model was used to assess the ambient impacts from a fugitive emission source (i.e., transfer of debris to truck bed) similar to the transfer/loading operations associated with the grinder source. The SCREEN3 model is based on a steady-state Gaussian plume algorithm, and is applicable for estimating ambient impacts from point, area, and volume sources out to a distance of about 50 kilometers.

6.1.4.1 Source Characterization

Due to the nature and extent of the grinding operations associated with this process, these sources are most appropriately modeled as volume sources and are similar to the transfer operations (i.e., truck loading) modeled in the U.S. EPA QAPP referenced in Section 6.1.1. The specific dimensions of the grinding equipment have not been finalized, but are assumed to be characteristic of the sources modeled previously.

6.1.4.2 SCREEN3 Model

SCREEN3 is the U.S. EPA's current regulatory screening model for many New Source Review (NSR) and other air permitting applications. The SCREEN3 model utilizes a predefined matrix of meteorological conditions that cover a range of wind speeds and stability categories (A through F), where the maximum wind speed is stability-dependent. The model is designed to estimate the worst-case impact based on a defined meteorological matrix for use as a "conservative" screening technique.

Results of the SCREEN3 modeling associated with modeling are shown in Figure 6-1 through Figure 6-3. These figures display the predicted concentration profiles as a function of distance for source release heights of seven, 12, and 15 feet. Multiple source release heights were evaluated because as the bed of the truck became full, the distance that the material will drop can change. The data from these figures also show that the maximum/peak concentrations, regardless of release height, occur within 15 feet of the source origin.

Due to the potential for damage to the air monitors within close proximity of the grinder and debris handling operations, the nearest lateral distance at which a monitor is able to be located is estimated to be a distance of 60 ft from the activity. Monitors will also be located at a more remote distance in order to collect additional data. Therefore, in order to assess the height at which the monitors will be placed, the SCREEN3 modeling results presented in Figure 6-1 through Figure 6-3 were used. These figures show that at distances ranging from 60 to 100 feet, the receptor height most impacted overall occurs at a receptor height of ten feet, with the greatest impact occurring at a source release height of 12 ft. Additionally, for a source release height of seven feet, the greater impacts occur at the five-ft receptor height, while for a source release height of 15 feet, the greater impacts occur at the 15-ft receptor height but drop off rapidly as distance from the source increases.

In order to account for potential impacts due to the transfer/loading operations, while also taking into account the contributions from lower-level fugitive sources not explicitly modeled or accounted for in the SCREEN3 results, a representative asbestos receptor/monitor height of 10 feet above ground level at distances of approximately 60 feet and five feet above ground level at distances of approximately 200-300 feet from the proposed operations will be used. This takes in to account the results of the modeling at various receptor heights, the consideration of additional low-level fugitive sources not included in the modeling, and the distance between the sources and monitors.

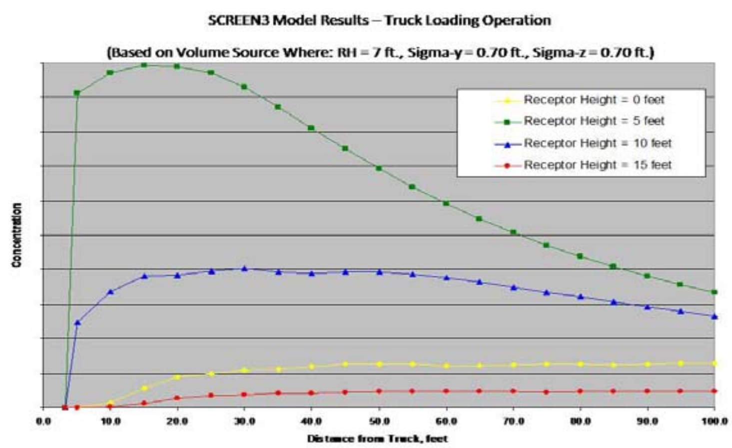


Figure B-1. SCREEN3 Results for Truck Loading Source (Release Ht =7 ft.)

Figure 6-1. SCREEN3 Results for Truck Loading Source (Release Ht =7 ft.)

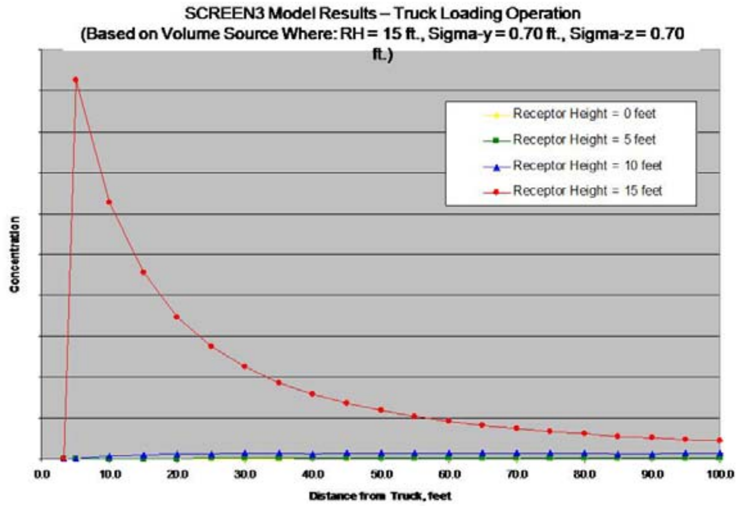


Figure 6-2. SCREEN3 Results for Truck Loading Source (Release Ht =15 ft).

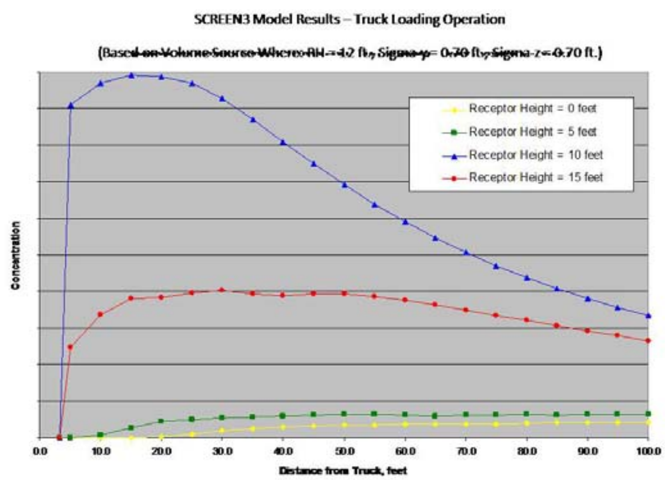


Figure B-2: SCREEN3 Results for Truck Loading Source (Release Ht =12 ft.)

Figure 6-3. SCREEN3 Results for Truck Loading Source (Release Ht =12 ft).

SECTION 7 SAMPLING METHOD REQUIREMENTS

7.1 Air Sampling

7.1.1 Perimeter (Ring 1 and 2) Air Sampling (Asbestos)

The samples for asbestos analysis will be collected on an open-face, 25-mm-diameter 0.45-µm pore size mixed cellulose ester (MCE) filters with a five-µm pore size MCE diffusing filter and cellulose support pad contained in a three-piece cassette with a 50-mm non-conductive cowl. This design of cassette has a longer cowl than the design specified in ISO 10312:1995, but it has been in general use for many years for ambient and indoor air sampling. Disposable filter cassettes with shorter conductive cowls, loaded with the appropriate combination of filter media of known and consistent origin, do not appear to be generally available.

The filter cassettes for Ring 1 will be positioned on a pole at 10 feet above ground; the filter cassettes for Ring 2 will be positioned on a pole or tripod that will accommodate cassette placement at 5 feet above ground.

High-Volume Samples (1,920 liters)—The filter assembly will be attached with flexible Tygon® tubing (or an equivalent material) to an electric-powered [110 volts alternating current (VAC)] 1/10-horsepower vacuum pump operating at an airflow rate of approximately four liters per minute yielding a target air volume of 1,920 liters. Portable 15-20 amp (1.0 or 3.5 kw) gasoline-powered generators will be used to power the sampling pumps.

Low-Volume Samples (960 liters)—The filter assembly will be attached with flexible Tygon® tubing (or an equivalent material) to an electric-powered [110 volts alternating current (VAC)] 1/10-horsepower vacuum pump operating at an airflow rate of approximately two liters per minute yielding a target air volume of 960 liters. The filter cassettes for Ring 1 only will be positioned at 10-feet above ground. *Note: If the low-volume air samples are not analyzed, they will be archived by the laboratory.*

7.1.2 Perimeter (Rings 1 and 2) Air Sampling (TSP/Lead/Other Metals)

The High Volume Sampler for TSP will be used to collect Particulate Matter during grinding operations using EPA Method IO-2.1 “Sampling of Ambient Air for Total Suspended Particulate Matter (SPM) and PM_{10} Using High Volume (HV) Sampler”. The monitoring stations will be operated eight hours during grinding operations. See Figure 7-1.

TSP glass fiber pre-weighed filters will be utilized and recorded for each sampling station. At the start of grinding operations, high volume sampling start-up information (including initial pressure or water column readings, ambient temperature and barometric pressure, start time, and date) will be recorded. After cleanup activities are completed, a final recording of pressure or water column, ambient temperature and barometric pressure, and time will be made. Filters will be removed and placed in envelopes as soon as possible to avoid additional deposition of wind-borne particulate matter. At the completion of the sampling, all sampling instruments will be turned off and each filter in each sampler removed.

7.1.3 Perimeter Air Sampling (Particulate as PM_{10})

The High Volume Sampler for PM_{10} as shown in Figure 7-1 will be used to collect Particulate Matter during grinding operations using EPA Method IO-2.1 “Sampling of Ambient Air for Total Suspended Particulate Matter (SPM) and PM_{10} Using High Volume (HV) Sampler” for a period of eight hours during the grinding operation.

PM_{10} quartz pre-weighed filters will be utilized and recorded for each sampling station. At the start of grinding operations, high volume sampling start-up information (including initial pressure or water column readings, ambient temperature and barometric pressure, start time, and date) will be recorded. After cleanup activities are completed, a final recording of pressure or water column, ambient temperature and barometric pressure, and time will be made. Filters will be removed and placed in envelopes as soon as possible to avoid additional deposition of wind-borne particulate matter. At the completion of the sampling, all sampling instruments will be turned off and each filter in each sampler removed.

Figure 7-1. Particulate sampler.

7.1.4 Worker Exposure Monitoring (Asbestos and Lead)

Asbestos—Personal breathing samples will be collected on open-face, 25-mm-diameter 0.8-µm pore size MCE filters with a cellulose support pad contained in a three-piece cassette with a 50-mm conductive cowl.[5] The filter assembly will be attached to a constant-flow, battery-powered vacuum pump operating at a flow rate of two liters per minute.

Lead—Personal breathing samples will be collected on closed-face, 37-mm diameter 0.8-µm pore size MCE filters with a cellulose support pad contained in a three-piece cassette in accordance with NIOSH Method 7300. The filter assembly will be attached to a constant-flow, battery-powered vacuum pump operating at a flow rate of two liters per minute.

7.1.5 Settled Dust Sampling (Asbestos)

Settled dust samples for asbestos analysis will be passively collected by using EPA-modified ASTM Method D 1739-98 *"Method for Collection and Measurement of Dustfall (Settleable Particulate Matter."* The collection container is an open-topped cylinder approximately six inches in diameter with a height of 12 inches. The container will not be equipped with a wind shield. The container will be fastened to the same sampling pole as the air samples at a height of five feet above the ground. One hour after completion of sampling, the dust collection container will be capped and sealed for shipment to the laboratory.

7.2 Water Sampling (Asbestos)

Samples of the source water used to wet the debris during handling activities and the resultant surface water will be collected for asbestos analysis. The sample container will be an unused, one-liter pre-cleaned, screw-capped bottle. Prior to sample collection the bottle will be rinsed with sample water. Two bottles will be collected for each sample taken. For source water, the sample will be collected directly from the hose into the sample container. For surface waters, samples will be collected by scooping water from any pooled areas. Approximately 800 milliliters of source water will be collected. An air space will be left in the bottle to allow efficient redispersal of settled material before analysis.

The samples will be transported to the analytical laboratory and filtered by the laboratory within 48 hours of each sample collection. No preservatives or acids will be added. At all times after collection, the samples will be stored in the dark at about 5° C (41° F) in order to minimize bacterial and algal growth. The samples will not be allowed to freeze because the effects on asbestos fiber dispersions are not known. On the same day of collection, the samples will be shipped in a cooler at about 5° C (41° F) to the laboratory for analysis via one-day courier service.

7.3 Grinder Input Sampling

---

[5] Although both 0.8-µm pore size and 0.45-µm pore size MCE filters are acceptable for sampling, the 0.45-µm pore size MCE filter is preferred when also performing TEM analysis of the sample because the particulate deposit closer to the filter surface. However, the higher pressure drop through the filter normally precludes their use with personal sampling pumps.

7.3.1 Inspection of Buildings to be Demolished

It is optimum that the buildings to be demolished and be subjected to the grinding operations be characterized in advance for asbestos and lead content. The sampling and analysis protocol in SECTION 13 will be used.

7.4 Grinder Output Sampling

A clean hand trowel will be used to collect the grab samples of the grinder output. The grab samples will be collected on an hourly basis. Two composite samples will be generated – one from the first four hours of grinding and one from the second four hours of grinding. Random sampling will be employed with respect to spatial coordinates to include grid and depth for each individual sample prior to composite. Each grab sample will represent at least 300 grams of material. Between collections of each grab sample, the hand trowel will be cleaned with detergent water (or equivalent material).

7.5 Meteorological Monitoring

A portable meteorological station will be used to record five-minute average wind speed and wind direction data, as well as temperature, barometric pressure, and relative humidity. A meteorological station and a backup will be installed at the Paris Road Landfill/debris collection site. The data files will be downloaded and archived by using an on-site personal computer. At least hourly direct readout of the data will be recorded on a Meteorological Measurement Log (Figure 5-8).

Selecting an appropriate site for the weather station is critical for obtaining accurate meteorological data. The instrument will be sited away from the influence of obstructions such as buildings and trees, and in such a position that it can make measurements that are representative of the general state of the atmosphere in the area of interest. Wind sensors (wind speed and direction) will be located over open level terrain. Open terrain is defined as an area where the distance between the instrument and any obstruction is at least ten times the height of that obstruction (EPA-450/4-87-013, June1987).

SECTION 8 SAMPLE CUSTODY REQUIREMENTS

Chain-of-custody procedures emphasize careful documentation of constant secure custody of samples during the field, transport, and analytical stages of environmental measurement projects. The sample custodian responsible for the proper chain-of-custody during this project is Seth Schultz or Craig Napolitano of The Louis Berger Group.

8.1 Field Chain-of-Custody

Each sample will have a unique project identification number. This identification number will be recorded on a Sampling Data Form (Figure 5-1 through Figure 5-4) along with the other information specified on the form. After the labeled sample cassettes and containers are inspected, the sample custodian will complete an Analysis Request and Chain-of-Custody Record (Figure 8-1). This form will accompany the samples, and each person having custody of the samples will note receipt of the same and complete an appropriate section of the form. Samples will be sent to the appropriate Laboratory (see Section 4.2, "*Laboratory Personnel*) via Federal Express Standard Overnight Service.

8.2 Analytical Laboratory

The laboratory's sample clerk will examine the shipping container and each sample cassette or container to verify sample numbers and check for any evidence of damage or tampering. Any changes will be recorded on the original chain-of-custody form. The sample clerk will log in all samples and assign a unique laboratory sample identification number to each sample and sample set.

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

Reference Document No. A- 0305
Page 1 of ____

Project Name ____
Project Number ____
Project Manager ____
Sample Team Leader ____

Lab Destination ____
Lab Contact/Phone ____
Lab Purchase Order No. ____
Carrier/Waybill No. ____

Report to: ____

Bill to: ____

ONE CONTAINER PER LINE

Sample Number	Sample Description/Type	Date/Time Collected	Container Type	Sample Volume	Pre-servative	Requested Analytical Method/(Parameters)	Condition on Receipt (Lab)

Special Instructions:

Possible Hazard Identification:
Non-hazard ☐ Flammable ☐ Skin Irritant ☐ Other ____

Sample Disposal:
Return to Client ☐ Disposal by Lab ☐ Archive ____ (mos.)

Turnaround Time Required:
Normal ☐ Rush ☐ Results Required by ____

QA Requirements:

1. Relinquished by (Signature/Affiliation) ____ Date: ____ Time: ____
1. Received by (Signature/Affiliation) ____ Date: ____ Time: ____

2. Relinquished by (Signature/Affiliation) ____ Date: ____ Time: ____
2. Received by (Signature/Affiliation) ____ Date: ____ Time: ____

Comments:

Figure 8-1. Analytical request and sampling chain-of-custody form.

SECTION 9 ANALYTICAL METHOD REQUIREMENTS

9.1 Air Samples (Asbestos – TEM)

Perimeter Samples—The 0.45-µm pore size mixed-cellulose ester (MCE) air sampling filters will be prepared and analyzed by using ISO Method 10312:1995 (1st Ed.), *Ambient Air - Determination of Asbestos Fibres - Direct-Transfer Transmission Electron Microscopy Method.*" After TEM analysis, a sector from the same filter will then be analyzed using PCM (see Section 9.2 "*Air Samples (PCM)*").

> Note: If a high density of particulate is present on the surface of the filter (i.e., approximately 20% coverage of the collection filter by particulate), the low volume samples will be utilized. If these are overloaded, then the high volume samples will be analyzed using ISO Method 13794:1999, "*Ambient Air – Determination of Asbestos Fibres – Indirect Transfer Transmission Electron Microscopy Method*."

Personal Samples— The 0.8-µm pore size mixed-cellulose ester (MCE) air sampling filters will be prepared and analyzed by using ISO Method 10312:1995, *Ambient Air - Determination of Asbestos Fibres - Direct-Transfer Transmission Electron Microscopy Method.*" Note: After TEM analysis, a sector from the same filter will then be analyzed using PCM (see Section 9.2 "*Air Samples (PCM)*").

9.1.1 Specimen Preparation

TEM specimens will be prepared from the air filters by using the dimethylformamide (DMF) collapsing procedure of ISO 10312:1995, as specified for cellulose ester filters. DMF will be used as the solvent for dissolution of the filter in the Jaffe washer. For each filter, a minimum of three TEM specimen grids will be prepared from a one-quarter sector of the filter by using 200-mesh indexed copper grids. The remaining part of the filter will be archived, in the original cassette in clean and secure storage, to be possibly selected for quality assurance analyses.

9.1.1.1 Measurement Strategy

1. The minimum aspect ratio for the analyses shall be 3:1, as permitted by ISO 10312:1995.

2. Table 9-1 presents the size ranges of structures that will be evaluated, and target analytical sensitivities and stopping rules.

3. The structure counting data shall be distributed approximately equally among a minimum of two specimen grids prepared from different parts of the filter sector.

4. The TEM specimen examinations will be performed at approximately 20,000 magnification.

5. PCM-equivalent asbestos fibers as defined in ISO 10312:1995 will also be determined.

6. The type of fiber, including non-asbestos amphiboles will be specified. Such fibers will be reported separately. In addition to classifying fibers as one of the six NESHAP-regulated asbestos varieties, all other amphibole mineral particles meeting the aspect ratio of ≥3:1 and lengths >0.5 µm) will be recorded. This includes non-NESHAP-regulated asbestos amphiboles (e.g., winchite, richterite). Reference to or implication of either use of the term cleavage fragments and/or discriminatory counting shall not apply.

Table 9-1. Target Analytical Sensitivity And Stopping Rules

Size Range	Target Analytical Sensitivity, s/cc	Approximate Magnification for Examination	Stopping Rule
TEM EPA-modified (ISO 10312:1995) All Structures (minimum length of 0.5 µm; aspect ratio ≥3:1)	0.0005	20,000	Count a minimum of four grid openings. If ≥100 structures are identified, counting is stopped. If <100 structures are identified, count until 100 structures are identified or the required number of grid openings to achieve an analytical sensitivity of 0.0005 asbestos structures/cm^3. Always complete the structure count for the last grid opening evaluated.

9.1.2 Determination of Stopping Point

The analytical sensitivity and detection limit of microscopic methods (such as TEM and PCM) are a function of the volume of air drawn through the filter and the number of grid openings or field counted. In principle, any required analytical sensitivity or detection limit can be achieved by increasing the number of grid openings or field examined. Likewise, statistical uncertainty around the number of fibers observed can be reduced by counting more fibers. Because of the open-ended nature of this situation, stopping rules are needed to identify when a microscopic examination should end, both at the low end (zero or very few fibers observed) and at the high end (many fibers observed).

9.2 Air Samples (Total Fibers – PCM)

Perimeter Samples—The 0.45-µm pore size MCE air sampling filters (described in Section 9.1 "Air Samples (TEM)") will be prepared and analyzed for total fibers by using NIOSH Method 7400 "*Asbestos Fibers by PCM*" (A Counting Rules). Fibers greater than five µm in length and with an aspect ratio greater than 3:1 will be counted.

Personal Samples—0.8-µm pore size MCE air sampling filters will be prepared and analyzed for total fibers by using NIOSH Method 7400 "*Asbestos Fibers by PCM*" (A Counting Rules). Fibers greater than five µm in length and with an aspect ratio greater than 3:1 will be counted.

9.2.1 Determination of Stopping Point

See Section 9.1.2 regarding the determination of counting stopping point.

9.3 Air Samples (TSP/Lead/Other Metals)

The high volume air sampling filters will be weighed (see section 9.4), prepared and analyzed using the following: Digestion will be conducted using EPA Method IO-3.1 "*Selection, Preparation and Extraction of Filter Material".* Digestates will be analyzed for metals using Inductively Coupled Plasma (ICP) Spectroscopy as described in EPA Method IO-3.4 "*Determination of Metals in Ambient Particulate Matter Using Inductively Coupled Plasma (ICP) Spectroscopy".*

9.4 Air Samples (TSP and Particulate as PM_{10})

Each filter is weighed to a constant weight (after moisture equilibration) before and after use to determine the net weight (mass) gained. The total volume of air sampled, corrected to EPA reference conditions (25 C, 101.3 kPa), is determined from the measured flow rate and the sampling time. The mass concentration of particulate in the ambient air is computed as the total mass of particulate divided by the volume of air sampled, and is expressed in micrograms per standard cubic meter (µg/std m3).

9.5 Settled Dust Samples (Asbestos)

The analytical sample preparation and analysis for asbestos will follow ASTM Standard D5755-03 "*Microvacuum Sampling and Indirect Analysis of Dust by Transmission Electron*

Microscopy for Asbestos Structure Number Surface Loading" as modified with the following exceptions:

- Section 8 - Sampling Procedure for Microvacuum Technique: The section is replaced with ASTM D 1739-98 sample collection procedure.

- Sections 10.4.1 through 10.4.3: Rinse the sample collection container with approximately 100ml of 50/50 mixture of particle-free water and reagent alcohol using a plastic wash bottle. Pour the suspension through a 1.0 by 1.0 mm opening screen into a pre-cleaned 500 or 1000 ml specimen bottle. All visible traces of the sample contained in the collection device shall be rinsed through the screen into the specimen bottle. Repeat the washing procedure three times. Discard the screen and bring the volume of the suspension in the specimen bottle up to 500ml with particle free water only.

- Section 16.2 Recording Data Rules – ISO 10312:1995 counting rules will be followed. The required analytical sensitivity is 250 s/cm^2.

9.6 Water Samples (Asbestos)

The asbestos content of the water samples will be determined by using EPA Method 100.2 "*Analytical Method Determination of Asbestos in Water*." All fibers greater than 0.5 µm in length and with an aspect ratio of greater than or equal to 3:1 will be counted. The required analytical sensitivity is 0.05 million s/L for the source water samples and 2 million s/L for the surface water samples.

9.7 Grinder Output (TCLP Metals)

TCLP Metals—The composite samples will be leached using EPA SW-846 Method 1311 and analyzed for arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver.

Asbestos-The composite samples will be analyzed for asbestos content using "*Method for the Determination of Asbestos in Bulk Building Materials*" (EPA/600/R-93/116, July 1993)

SECTION 10 Quality Control Requirements

10.1 Field Quality Control Checks

Quality control checks for the field sampling aspects of this project will include, but not be limited to, the following:

- Use of standardized forms to ensure completeness, traceability, and comparability of the data and samples collected.

- The air flow rate of the sampling pump will be set to the target value and measured at the beginning, then every two hours with adjustments as necessary, and at the end of the sampling period. If the flow rate deviates more than ten percent, the impact to the results will be evaluated and the sample will be adjusted to its intended volume. All adjustments and readings will be recorded and factored in to a TWA over the sampling period of time to achieve the sample total volume.

- Proper handling of air sampling filters to prevent cross contamination.

- Collection of field blanks and field duplicate samples.

- Field cross-checking of data forms to ensure accuracy and completeness.

10.2 Field QC for Air Samples for Asbestos and Total Fibers

10.2.1 Field Blanks

Field blank samples are used to determine if any contamination has occurred during sample handling. Field blanks will be collected each day of sampling. Field blanks are filter cassettes that have been transported to the sampling site, opened for a short-time ($\leq$ 30 seconds) without any air having passed through the filter, and then sent to the laboratory.

10.2.2 Field Duplicates

A duplicate sample is a second sample collected concurrently at the same location as the original sample.

10.3 Field QC for Air Samples for TSP/Metals and PM_{10}

10.3.1 Field Blanks

Field blank samples are used to determine if any contamination has occurred during sample handling. Field blanks are pre-weighed filters that have been transported to the sampling site, opened, placed in the sampler and removed immediately and placed in a clean envelope without any air having passed through the filter, and then removed and sent to the laboratory. For metals, these same filters will be digested and analyzed.

10.3.2 Field Duplicates

A duplicate sample is a second sample collected concurrently at the same location as the original sample.

10.4 Field QC for Settled Dust

Field QC settled dust samples will include field blanks and field duplicates.

10.4.1 Field Blanks

A field blank is prepared by placing a collection device in the field, removing the lid, and then immediately replacing the lid.

10.4.2 Field Duplicates

A duplicate sample is a second sample collected concurrently at the same location as the original sample.

10.5 Field QC for Water

10.5.1 Field Blanks

A field blank is a clean glass container containing approximately 800 ml of laboratory water. The container filled with water will be provided by the laboratory. The container will be opened in the field for approximately 30 seconds.

10.5.2 Field Duplicate

A duplicate sample is a second sample collected concurrently at the same location as the original sample, but is collected after the original sample is collected.

10.6 Asbestos Laboratory Quality Control Checks

10.6.1 Air

10.6.1.1 Lot Blanks

Before air samples are collected, a minimum of two percent of unused filters from each filter lot of 100 filters will be analyzed to determine the mean asbestos structure count. The lot blanks will be analyzed for asbestos structures by using ISO 10312:1995. If the mean count for all types of asbestos structures is found to be more than ten structures/mm^2, the filter lot will be rejected.

10.6.1.2 Laboratory Blank

Laboratory blanks are unused filters (or other sampling device or container) that are prepared and analyzed in the same manner as the field samples to verify that reagents, tools, and equipment are free of the subject analyte and that contamination has not occurred during the analysis process. The laboratory will analyze at least one blank for every ten samples or one blank per prep series. Blanks are prepared and analyzed along with the other samples. If the blank control criteria (Section 10.6.1.1) are not met, the results for the samples prepared with the contaminated blank are suspect and should not be reported (or reported and flagged accordingly). The preparation and analyses of samples should be stopped until the source of contamination is found and eliminated. Before sample analysis is resumed, contamination-free conditions shall be demonstrated by preparing and analyzing laboratory clean area blanks (see Section 10.6.1.3) that meet the blank control criteria. Laboratory blank count sheets should be maintained in the project folder along with the sample results.

Table 10-1. Analytical Methods and Quality Assurance (QA)/Quality Control (QC) Checks For Asbestos, TSP/Metals Analysis, PM_{10} and Leachable Metals

Matrix	Analyte	Method and Analytical Sensitivity	QA/QC Checks	Frequency	Acceptance Criteria	Corrective Action if Acceptance Criteria Not Met
Perimeter Air	Asbestos by TEM	EPA-modified ISO Method 10312:1995; 0.0005 s/cm^3	Lot Blanks	two % of unused filters	<10 asbestos s/mm^2	Reject filter lot
			Laboratory Blanks	Each sample batch	<10 asbestos s/mm^2	Collect and analyze clean area blanks; re-prep filter samples
			Laboratory Clean Area Blanks	Whenever laboratory blanks do not meet criteria	<10 asbestos s/mm^2	Find and eliminate source of contamination
			Replicate Analysis (recount by same analyst)	four samples (two samples per ring)	Acceptable Analytical Variability from Table 10-2	Re-examine grids to determine cause of variation
			Verification Counting (intralab and interlab)	four samples (two samples per ring)	>80% true positives, <20% false negatives, <20% false positives	Re-examine grids to determine cause of variation
			Duplicate Analysis (reprep and analysis by same analyst)	four samples (two samples per ring)	Acceptable Analytical Variability from Table 10-2	Re-examine grids to determine cause of variation; re-prep filter samples
			Interlaboratory Duplicates	4 samples (two samples per ring)	Acceptable Analytical Variability from Table 10-2	Re-examine grids to determine cause of variation; re-prep filter samples

Matrix	Analyte	Method and Analytical Sensitivity	QA/QC Checks	Frequency	Acceptance Criteria	Corrective Action if Acceptance Criteria Not Met
Worker Air	Total Fibers by PCM	NIOSH Method 7400; 0.01 f/cm^3	Blind recounts on reference slides	Daily	Per laboratory control charts	Investigate source of imprecision; re-count reference slides
			Blind recounts on filter samples	10%	See Step 13 of Method 7400	Investigate source of imprecision; re-count filter sample
	Asbestos by TEM	EPA-modified ISO Method 10312:1995; 0.005 s/cm^3	Lot Blanks	2% of unused filters	<10 asbestos s/mm^2	Reject filter lot
			Laboratory Blanks	Each sample batch	<10 asbestos s/mm^2	Collect and analyze clean area blanks; re-prep filter samples
			Laboratory Clean Area Blanks	Whenever laboratory blanks do not meet criteria	<10 asbestos s/mm^2	Find and eliminate source of contamination
			Replicate Analysis	One sample	Acceptable Analytical Variability from Table 10-2	Re-examine grids to determine cause of variation
			Verification Counting	One sample	>80% true positives, <20% false negatives, <20% false positives	Re-examine grids to determine cause of variation
			Duplicate Analysis (reprep and analysis by same analyst)	One sample	Acceptable Analytical Variability from Table 10-2	Re-examine grids to determine cause of variation; re-prep filter samples

Matrix	Analyte	Method and Analytical Sensitivity	QA/QC Checks	Frequency	Acceptance Criteria	Corrective Action if Acceptance Criteria Not Met
Worker Air	Lead by ICP-AES	5 µg/m^3 NIOSH 7300	Laboratory Blank	1/batch or 1/10 samples, whichever is greater	<3 µg/sample	Investigate source of contamination; evaluate impact on sample results
			Spiked Blank Filters/Spiked Blank Filter Duplicates	1/batch or 1/10 samples, whichever is greater	75-125%; 20% RPD	Investigate source of error; evaluate impact on sample results

Matrix	Analyte	Method and Analytical Sensitivity	QA/QC Checks	Frequency	Acceptance Criteria	Corrective Action if Acceptance Criteria Not Met
Settled Dust	Asbestos by TEM	EPA-modified ASTM D 5755-03; 250 str/cm^2	Lot Blanks	2% of unused filters	<10 asbestos s/mm^2	Reject filter lot
			Laboratory Blanks	1 per 10 samples or each sample batch	<10 asbestos s/mm^2	Collect and analyze clean area blanks; re-prep filter samples
			Laboratory Clean Area Blanks	Whenever laboratory blanks do not meet criteria	<10 asbestos s/mm^2	Find and eliminate source of contamination

Matrix	Analyte	Method and Analytical Sensitivity	QA/QC Checks	Frequency	Acceptance Criteria	Corrective Action if Acceptance Criteria Not Met
			Replicate Analysis	Four samples (two per ring)	Acceptable Analytical Variability from Table 10-2	Re-examine grids to determine cause of variation
			Duplicate Analysis	Four samples (two per ring)	Acceptable Analytical Variability from Table 10-2	Reprepare and re-examine sample to determine cause of variation; re-prep filter samples

Matrix	Analyte	Method and Analytical Sensitivity	QA/QC Checks	Frequency	Acceptance Criteria	Corrective Action if Acceptance Criteria Not Met
Grinder Output	TCLP Metals	0.1 mg/L Method 1311	Extraction Blank	One	<0.1 mg/L	Investigate source of contamination; evaluate impact on sample results
			MS/MSD	One	75-125%; 20% RPD	Investigate source of error; evaluate impact on sample results
	Asbestos	0.1% EPA/600/R-93/116, July 1993	Duplicate	One	20% RPD	Investigate source of error; evaluate impact on sample results

Matrix	Analyte	Method and Analytical Sensitivity	QA/QC Checks	Frequency	Acceptance Criteria	Corrective Action if Acceptance Criteria Not Met
Water	Asbestos by TEM	Modified EPA 100.2; 0.05 million str/liter source 2 million str/ liter runoff	Lot Blanks	2% of unused filters	<10 asbestos s/mm^2	Reject filter lot
			Laboratory Blanks	1 per 10 samples or each sample batch	<10 asbestos s/mm^2	Collect and analyze clean area blanks; re-prep filter samples
			Laboratory Clean Area Blanks	Whenever laboratory blanks do not meet criteria	<10 asbestos s/mm^2	Find and eliminate source of contamination
			Replicate Analysis	1 sample	Acceptable Analytical Variability from Table 10-2	Re-examine grids to determine cause of variation
			Duplicate Analysis	1 sample	Acceptable Analytical Variability from Table 10-2	Reprepare and re-examine sample to determine cause of variation

Matrix	Analyte	Method and Analytical Sensitivity	QA/QC Checks	Frequency	Acceptance Criteria	Corrective Action if Acceptance Criteria Not Met

Matrix	Analyte	Method and Analytical Sensitivity	QA/QC Checks	Frequency	Acceptance Criteria	Corrective Action if Acceptance Criteria Not Met
Ambient Air	TSP, PM_{10}	EPA Method IO-3.1 0.01 mg	Analysis of S-Class certified weights	Daily	3 gram NIST standard weight 2.9995-3.0005	Recalibrate balance and repeat QC check of S-class weights
			Duplicates (second analyst)	10% of the filters	Difference between the weights is less than 1.0 mg for tare and 2.0 mg for final weights	Reweigh 100% of that lot and use the last reweigh weight
	Metals	EPA Method IO-3.4 1-50 ng/m^3	Method Blank	Each sample batch or with every ten filters, whichever is greater.	< 5 times the instrument detection limit	Find and eliminate source of contamination
			Matrix Spike	Each sample batch or with every ten filters, whichever is greater.	75-125% Recovery	Investigate source of error; evaluate impact on sample results
			Duplicate	Each sample batch or with every ten filters, whichever is greater.	20 RPD	Investigate source of error; evaluate impact on sample results

10.6.1.3 Laboratory Clean Area Blanks

Clean area blanks are prepared whenever contamination of a single laboratory prep blank exceeds the criteria specified in Section 10.6.1.1or whenever cleaning or servicing of equipment has occurred. To check the clean area, a used filter is left open on a bench top in the clean area for the duration of the sample prep process. The blank is then prepared and analyzed by using ISO Method 10312:1995. If the blank control criteria (see Section 10.6.1.1) are not met, the area is cleaned by using a combination of HEPA-filter vacuuming and a thorough wet-wiping of all surfaces with amended water. In addition, air samples should be taken in the sample prep room to verify clean air conditions. At least 2,500 liters of air should be drawn through a 25-mm-diameter 0.45-µm pore size MCE filter by using a calibrated air sampling pump. The samples should then be analyzed by using ISO Method 10312:1995. If blank control criteria are not met, sample preparation shall stop until the source of contamination is found and eliminated. Clean area sample results shall be documented.

10.6.1.4 Replicate Analysis

The precision of the analysis is determined by an evaluation of repeated analyses of randomly selected samples. A replicate analysis will be performed on a percentage of the samples analyzed to assess the precision of the counting abilities of the individual analysts. A replicate analysis is a second analysis of the same preparation, but not necessarily the same grid openings, performed by the same microscopist as in the original analysis. The conformance expectation for the replicate analysis is that the count from the original analysis and the replicate analysis will fall within an acceptable analytical variability as shown in Table 10-2.

Table 10-2. Accepted Analytical Variability for Asbestos Sample Re-Analysis[ab]

Type of Sample		Accepted Variability
Air Samples	Replicate	1.96
	Duplicate	2.24
	Interlab duplicate	2.24
Non-Air Samples	Replicate	2.24
	Duplicate	2.50

[a]Analytical Variability = $\dfrac{\left|(\text{Analysis A}) - (\text{Analysis B})\right|}{\sqrt{(\text{Analysis A} + \text{Analysis B})}}$

[b] Asbestos only

This variability is the absolute value of the difference of the two analyses, divided by the square root of the sum, which is an estimate of the standard deviation of the difference based on a Poisson counting model. For replicate air samples, for which the simple Poisson model is most directly applicable, the value 1.96 is chosen so that the criterion will flag approximately one replicate pair out of 20 for which the difference is due only to analytical variability, i.e., it has a "false positive" rate of 5%. For the other types of analyses, where greater natural variability is expected than indicated by a pure Poisson model, the criterion value has been increased from 1.96 in order to avoid flagging too many cases where the difference between the values is due only to normal variation, and not to any problem with either analysis. The values 2.24 and 2.50 were selected as targeting false positive rates of 2.5% (1/40) and 1.125% (1/80) for the Poisson model.

Example 1: For replicate air samples where A = 0 fiber and B = 3 fibers, the variation is considered acceptable, while A = 0 and B = 4 would be flagged for further investigation. Likewise A = 1 and B = 6 is acceptable, while A = 1 and B = 7 is flagged. At higher levels, A = 20 and B = 34 is acceptable, but A = 10 and B = 24 is flagged.

10.6.1.5 Duplicate Analysis

A duplicate sample analysis is also performed on a percentage of the samples analyzed to assess the reproducibility of the analysis and quantify the analytical variability due to the filter preparation procedure. A duplicate analysis is the analysis of a second TEM grid preparation prepared from a different area of the sample filter performed by the same microscopist as the original analysis. The conformance expectation for the duplicate analysis is that the counts from the original and duplicate analyses will fall within the acceptable analytical variability shown in Table 10-2.

10.6.1.6 Verification Counting

Due to the subjective component in the structure counting procedure, it is necessary that recounts of some specimens be made by a different microscopist (i.e., a microscopist different than the one that performed the original analysis) in order to minimize the subjective effects. Verification counting will be done by more than one analyst in the initial laboratory and also by the QA laboratory. Counting will involve re-examination of the same grid openings by the participating analysts. Such recounts provide a means of maintaining comparability between counts made by different microscopists. Repeat results should result in a level of consensus between laboratories such that both laboratories have >80% true positives, <20% false negatives, and <20% false positives in their verified counting analysis of asbestos structures.

10.6.1.7 Interlaboratory Duplicates

The QA laboratory will analyze a percentage of the air samples (TEM) as an independent check of the results of the primary laboratory. These analyses will be performed on a separate sector of the filter. The filter will be provided by the primary laboratory to the QA laboratory. The conformance expectation for interlaboratory QC checks is that the counts from the original analysis and the interlaboratory QC check will fall within the acceptable analytical variability.

10.6.2 Settled Dust

10.6.2.1 Laboratory Blanks

A laboratory blank is prepared by filtering water through the same type of filter used to prepare TEM grids. A sample blank should be prepared each time a new batch of filters is opened and each time the filtering unit is cleaned. Blanks will be considered contaminated if they have greater than or equal to ten asbestos structures per square millimeter. The source of the contamination must be found before any further analysis can be performed. Reject samples that are processed along with the contaminated blank samples and prepare new samples after the source of the contamination is found.

10.6.2.2 Laboratory Duplicates

A duplicate sample analysis is also performed on a percentage of the samples analyzed to assess the reproducibility of the sample preparation and analysis. A duplicate analysis is the analysis of a second aliquot of the original dust samples aqueous suspension.

10.6.2.3 Replicate Analysis

Replicate analysis will be performed on a percentage of the samples as described for the air samples in Section 10.6.1.4 "*Replicate Analysis.*"

10.6.3 Worker

10.6.3.1 Laboratory Blanks

A laboratory blank is prepared by filtering water through the same type of filter used to prepare TEM grids. A sample blank should be prepared each time a new batch of filters is opened and each time the filtering unit is cleaned. Blanks will be considered contaminated if they have greater than or equal to ten asbestos structures per square millimeter. The source of the contamination must be found before any further analysis can be performed. Reject samples that are processed along with the contaminated blank samples and prepare new samples after the source of the contamination is found.

10.6.3.2 Laboratory Duplicates

A duplicate sample analysis is also performed on a percentage of the samples analyzed to assess the reproducibility of the sample preparation and analysis. A duplicate analysis is the analysis of a second TEM grid preparation prepared from a different area of the sample filter performed by the same microscopist as the original analysis.

10.6.3.3 Replicate Analysis

Replicate analysis will be performed on a percentage of the samples as described for the air samples in Section 10.6.1.4 "*Replicate Analysis.*"

10.6.4 Water

10.6.4.1 Laboratory Blanks

A laboratory blank is prepared by filtering 100 mL of water through the same type of filter used to prepare TEM grids. A sample blank will be prepared with each sample set.

10.6.4.2 Laboratory Duplicates

A duplicate sample analysis is also performed on one of the samples analyzed to assess the reproducibility of the sample preparation and analysis. A duplicate analysis is the analysis of a second aliquot of the original water sample.

10.6.4.3 Replicate Analysis

Replicate analysis will be performed on one of the samples as described for the air samples in Section 10.6.1.4 "*Replicate Analysis*."

10.7 Metals Laboratory QC

10.7.1 Air

10.7.1.1 Laboratory Blanks

A laboratory blank is prepared by adding the same quantity of acid to digest a filter to an empty glass beaker. A sample blank should be prepared with each sample batch or with every ten filters, whichever is greater. Blank concentrations should be less than 5 times the instrument detection limit.

10.7.1.2 Matrix Spikes

A second filter strip will be spiked with the target metals. These spiked samples should be prepared with each sample batch or with every ten filters, whichever is greater. Recoveries should fall within 75-125 percent.

10.7.1.3 Duplicates

A second filter strip will be prepared as a duplicate. These duplicate samples should be prepared with each sample batch or with every ten filters, whichever is greater. Precision should be less than 20 RPD.

10.8 Grinder Output QC (TCLP Metals)

10.8.1 Extraction Blank

A TCLP extraction blank will be prepared and analyzed.

10.8.2 Matrix Spike/Matrix Spike Duplicates (MS/MSD)

One MS/MSD pair will be prepared and analyzed for each of the eight metals.

10.9 TSP/PM_{10} Laboratory QC

10.9.1 Balance Check

The balance calibration should be checked daily with a minimum of one Class S weight.

10.9.2 Duplicate Weighing

A second analyst should reweigh 10% of the filters. For initial filter tare weights, if the difference in weight is less than 1 mg, the results are acceptable. For the final filter weights, if the difference in weight is less than 2 mg, the results are acceptable. If the differences are greater than these differences, wait another 24 hours and reweigh the filters.

A summary of the analytical methods and the laboratory quality assurance/quality control (QA/QC) checks is presented in Table 10-1.

SECTION 11 INSTRUMENT/EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE REQUIREMENTS

11.1 Field Instrumentation/Equipment

Field equipment/instruments (e.g., sampling pumps, meteorological instrumentation) will be checked and calibrated before they are shipped or carried to the field. The equipment and instruments will be checked and calibrated at least daily in the field before and after use. Spare equipment such as air sampling pumps, precision flow meters, and flow control valves will be kept on site to minimize sampling downtime. Backup instruments (e.g., meteorological instrumentation) will be available within one day of shipment from a supplier.

11.2 Laboratory Equipment/Instrumentation

As part of the Laboratory's QA/QC Program, a routine preventive maintenance program is performed to reduce instrument failure and other system malfunctions of transmission and scanning electron microscopes. The laboratory has an internal group and equipment manufacturers' service contract to perform routine scheduled maintenance, and to repair or to coordinate with the vendor for the repair of the electron microscope and related instruments. All laboratory instruments are maintained in accordance with manufacturer specifications and the requirements of ISO Method 10312:1995.

11.3 INSTRUMENT CALIBRATION AND FREQUENCY

11.3.1 Field Instrument/Equipment Calibration

11.3.1.1 Air Sampling Pumps

The air sampling pumps with a flow control valve will be evaluated to ensure that they are capable of maintaining a stable flow rate for a given static pressure drop; i.e., the pumps can maintain an initial volume flow rate of within +/- 10% throughout the sampling period. Prior to use, the sampling pumps will be tested against the pressure drop created by a 25-mm-diameter 0.45-µm pore size MCE filter with a five-µm pore size MCE backup diffusing filter and cellulose support pad contained in a three-piece cassette with 50-mm cowl at a flow rate of approximately two and four liters per minute at standard temperature and pressure (STP).

11.3.1.2 Airflow Calibration Procedure

Fixed-Station Electric Powered—Each pump will be calibrated by using a primary standard airflow calibrator (Gilabrator electronic flow meter or equivalent). These calibrations will be performed initially, after every two hours, and at the end of the sampling period.

A detailed written record will be maintained of all calibrations. The record will include all relevant calibration data, including the following elements:

- Gilabrator model (or equivalent) and serial number
- Sampling train (pump, flow control valve, and filter)
- X- and Y- coordinate calibration data
- Intercept, slope, and correlation coefficient from a linear regression analysis of the calibration data, and resulting linear regression equation that will be used to determine the sampling flow rate
- Relevant calculations
- Dry bulb temperature
- Name of person/affiliation that performed the calibration and linear regression analysis

Constant-Flow Personal Sampling Pumps—Each sampling pump will be calibrated by using a primary standard airflow calibrator (Gilabrator electronic flow meter or equivalent). These calibrations will be performed initially, after every two hours, and at the end of the sampling period. A detailed written record will be maintained of all calibrations, as described above. The air flow rate will be measured immediately before and after collection of each sample.

11.3.1.3 TSP/PM_{10} Calibration

The following is a step-by-step procedure for calibrating the pumps. These samplers are calibrated once upon being placed in the sampling positions.

1. Record the calibration location, date, time, technician’s name, the sampler type (e.g. PM10 Pump Number Assigned), and the unit serial number.

2. Record the make, model, and serial number for the orifice transfer standard.

3. Record the Slope (m), y-Intercept (b), and correlation coefficient from the transfer standard's orifice certification form.

4. Examine the monitoring unit and document any damage, missing parts, or equipment malfunctions.

5. Ensure the base of the unit is secure, tilt shelter lid back.

6. Loosen the four plastic thumb nuts that clamp the filter cartridge together and remove the upper portion of the filter cartridge.

7. Place the Variflow Orifice Transfer Standard on the threaded section of the faceplate and secure firmly with the plastic flange nuts. Set the Variflow Orifice Standard to the close position.

8. Connect the transfer standard orifice to the inlet of the sampler. Connect the orifice manometer to the orifice pressure tap. Verify there are no leaks between the orifice unit and the sampler (ORIFICE MANOMETER).

9. Connect the second manometer to the venturi pressure tap located beneath the filter housing. This manometer will be utilized to read the stagnation pressure (e.g. vacuum) beneath the filter housing; Be certain to convert units read on the SAMPLER Manometer from inches of water to mm Hg in order to maintain the consistency of units required for the calculations. The conversion formula is as follows: mm Hg= 25.4 (inches H_2O/13.6)

10. Verify that the flow indicator or recorder is properly connected to the pressure tap on the lower side of the high volume sampler motor housing. Install a clean flowchart in the recorder and adjust the recorder pen to read zero.

11. Operate sampler for five minutes to establish thermal equilibrium prior to calibration.

12. Insert the appropriate resistance plate to achieve desired flow rate; indicate in column labeled orifice (Figure I Appendix B), the resistance plate utilized (e.g. 18 hole, 13 hole, 10 hole, 7 hole, 5 hole). As an alternate to using the resistance plates, employ the VariFlow Orifice device.

13. Allow the sampler to run for at least 2 minutes to re-establish the run-temperature conditions.

14. Read and record the differential pressure reading (e.g. Water Column Differential) across the transfer standard (Orifice Manometer) and the corresponding Water Column Differential across the Sampler Manometer.

15. Repeat this process for the remaining resistance plates, or four (4) additional points utilizing the Variflow calibrator.

16. Upon completion of the 5-point calibration, turn sampler off, and remove Orifice Transfer Standard and Manometer. Place a filter on the cassette, turn sampler back-on and record

Sampler Manometer deflection only. This reading will be recorded in the "Sampler Section", as a sixth point, on the Calibration field sheet.

17. Calculate the orifice Qa (actual volumetric flow rate in m3/min) for each calibration point utilizing the following equation. The slope and y-intercept for VFC units are to be taken from the Qa section of the Orifice Calibration Worksheet:

Equation No. 5.2-1 (VFC)

Orifice $Q_a = \{[\text{Delta } H_2O\ (T_a/P_a)]^{1/2} - b\}/m$

Where: Qa = Actual volumetric flow rate
Delta H2O = Pressure drop across orifice (mm or inches of H_2O)
P_a = Ambient barometric pressure during use, mm Hg
Ta = Ambient temperature during use, degrees Kelvin
P_2 = Ambient Pressure in mm Hg
T_2 = Ambient Temperature (Converted to Kelvin)
b = y - intercept from transfer standard orifice certification
m = slope from transfer standard orifice certification

18. Calculate and record the absolute stagnation pressure, P1, for each sampling point utilizing the following formula:

Equation No. 5.2-2 (VFC)

P1 = Pa – DeltaPstg
P1 = absolute stagnation pressure, mm Hg (e.g. will need to convert from water column)
Pa = ambient barometric pressure
DeltaPstg= relative stagnation pressure

19. Calculate and record the stagnation pressure ratio, as follows:

Equation No. 5.2-3 (VFC)

Stagnation Pressure Ratio = P1/Pa

20. Plot the orifice Qa (x-axis) vs. the stagnation pressure ratios (y-axis) on graph paper.

21. Calculate the linear regression slope (m), intercept (b), and correlation coefficient (r). For the general linear regression model y = mx + b, let y = Pl/Pa (i.e.stagnation pressure ratio) and let x = Qa (orifice)/[Ta]"2 + b.

22. Utilizing "Look-up Table", which comes with sampler calibration kit, compare Qa (orifice measurements) for several points on the calibration curve with Qa (sampler measurements) determined from the factory calibration at actual temperature. Calculate the percentage difference between the values. If agreement is +/- 3 to 4 %, the factory calibration is validated and can be used for subsequent sampling periods. If there is not agreement replace filter and restart procedures.

23. For subsequent sample periods, the sampler's average actual operating flow rate:

Equation No. 5.2-4 (VFC)

$$Qa\ (sampler) = \{[(P1/Pav) - b]\ [Tav]^{1/2}\}/m$$

Where: **Qa (sampler) = Sampler's average actual flow rate, m3/min;**
Pl/Pav = Average stagnation pressure ratio for the sampling period;
Tav = Average ambient temperature for the sampling period in degrees Kelvin (i.e. Degrees K = Degrees Celsius + 273);
b = Intercept of the sampler calibration relationship;
m = Slope of the sampler calibration relationship.

11.3.2 Calibration of TEM

The TEM shall be aligned according to the specifications of the manufacturer. The TEM screen magnification, electron diffraction (ED) camera constant, and energy dispersive X-ray analysis (EDXA) system shall be calibrated in accordance with the specifications in ISO Method 10312:1995, Annex B.

11.4 INSPECTION/ACCEPTANCE REQUIREMENTS FOR SUPPLIES AND CONSUMABLES

11.4.1 Air Sampling Filter Media

See Section 10.6.1.1regarding the quality control check of the filter media.

11.5 NON-DIRECT MEASUREMENTS

No data are needed for project implementation or decision making that will be obtained from non-measurement sources such as computer data bases, programs, literature files, or historical data bases.

11.6 DATA MANAGEMENT

Commercially available computer hardware and software are used to manage measurement data to ensure the validity of the data generated. Controls include system testing to ensure that no computational errors are generated and evaluation of any proposed changes to the system before they are implemented. Commercially available software does not require testing, but validation of representative calculations is required by using alternative means of calculations.

Field and laboratory data will be entered into a Microsoft Excel spreadsheet to facilitate organization, manipulation, and access to the data. Field data will include information such as sampling date, sample number, sampling site, sample description and location, sample type, air volume, and sampling period. Laboratory data will include information such as sample number, date sample received and analyzed, type of analysis, magnification, grid location, grid square area, filter type, number of grids examined, number of asbestiform structures counted, structure type (fiber, bundle, cluster, or matrix), and structure length and width. An example format for reporting the structure counting data is contained in Figure 7 of ISO Method 10312:1995.

11.6.1 Data Assessment

Sample data will be reviewed by the laboratory during the reduction, verification, and reporting process. During data reduction, all data will be reviewed for correctness by the microscopist or analyst. A second data reviewer will also verify correctness of the data. Finally, the Laboratory Director at each primary laboratory (as applicable) will provide one additional data review to verify completeness and compliance with the project QAPP. Any deficiencies in the data will be documented and identified in the data report.

11.7 ASSESSMENT/OVERSIGHT

11.7.1 ASSESSMENT AND RESPONSE ACTIONS

11.7.1.1 Performance and System Audits

11.7.1.1.1 Field Audit

EPA-ORD (or its representative) will audit the field sampling and data collection activities at grinder site. The audit will include, but not be limited to, the examination of sample collection and equipment calibration procedures, sample labeling, sampling data and chain-of-custody forms, and other sample collection and handling requirements specified in the QAPP. The auditor will document any deviations from the QAPP so that they can be corrected in a timely manner.

Prior to leaving the site, the auditor will debrief the EPA-ORD Task Order Manager, EPA-ORD Quality Assurance Manager, and the Cadmus/Berger Project Manager regarding the results of the audit and any recommendations, if necessary. The results of the audit will be presented in a written report prepared by the auditor to the EPA-ORD Quality Assurance Manager and Task Order Manager.

11.7.1.1.2 Laboratory Audits

EPA-ORD (or its representative) will conduct one independent laboratory quality assurance audit of Bureau Veritas. This audit will be conducted following sample receipt to verify that all procedures specified in the QAPP are being implemented. The auditor will summarize the results of the audit(s) in a written report to EPA-ORD Task Order Manager within 2 weeks of the audit. If any serious problems are identified that require immediate action, the auditor will verbally convey these problems at the time of the audit to the EPA-ORD Task Order Manager.

11.8 Corrective Action

Sampling and analytical problems may occur during sample collection, sample handling and documentation, sample preparation, laboratory analysis, and data entry and review. Immediate on-the-spot corrective actions will be implemented whenever possible and will be documented in the project record. Implementation of the corrective action will be confirmed in writing through a memorandum to the EPA Task Order Manager.

11.9 Reports to Management

Effective communication is an integral part of a quality system. Planned reports provide a structure to inform management of the project schedule, deviations from the approved QAPP, impact of the deviations, and potential uncertainties in decisions based on the data.

The Cadmus/Berger Project Manager will provide verbal progress reports to the EPA Task Order Manager. These reports will include pertinent information from the data processing and report writing progress reports and corrective action reports, as well as the status of analytical data as determined from conversations with the laboratory. The Cadmus/Berger Project Manager will promptly advise the EPA-ORD Task Order Manager on any items that may need corrective action.

The final project report will be prepared in accordance with the guidelines specified in the EPA Handbook for Preparing ORD Reports, EPA/600K/95/002.

11.10 Data Validation and Usability

11.10.1 DATA REVIEW, VERIFICATION, AND VALIDATION

The analytical laboratory will perform in-house analytical data reduction and verification under the direction of the laboratory's Quality Assurance Manager. The laboratory's Quality Assurance Manager is responsible for assessing data quality and advising of any data rated as "unacceptable" or other notations that would caution the data user of possible unreliability. The analytical results will be compared to the stated data quality indicators for each data quality objective.

Data verification and data validation will be conducted in accordance with EPA "*Guidance on Environmental Data Verification and Data Validation*," EPA QA/G-8 (EPA/240/R-02/004, November 2002). This will be performed by Berger's QA Officer.

Data verification is the process of evaluating the completeness, correctness, and conformance/compliance of a specific data set against the method or QAPP requirements. The goal of data verification is to ensure and document that the data are what they purport to be; i.e., that the reported results reflect what was actually done.

Data validation is the analyte- and sample-specific process that extends the evaluation of the data beyond data verification. Data validation continues with the review of the raw analytical data and analysis notes. The data review will identify any out-of-control data points and data omissions. Based on the extent of the deficiency and its importance in the overall data set, the laboratory may be required to re-analyze the sample. Included in the data validation of a sample set will be an assessment of chain-of-custody and analyses of field quality control samples. Analytical data not appearing to be valid or not meeting data quality indicators will be flagged and reported to the EPA Task Order Manager.

11.10.2 DATA AND SAMPLE ARCHIVE

Data and sample storage encompasses an archive of all collected samples, generated electronic files, and any laboratory notes collected during collection or analysis of samples. Upon completion of the analysis, the respective laboratory will store the remaining portions of the samples or sample preparations (e.g., TEM grids) until such materials are requested to be shipped to EPA. *Note: No samples or sample preparations will be discarded.*

Following submission of the final project report, all laboratory and field records/files (paper and electronic) will be transferred to the Cadmus/Berger Project Manager. The Cadmus/Berger Project Manager will then transfer the complete project file to the EPA-ORD Task Order Manager for permanent retention.

11.11 PROJECT CLOSEOUT

At the conclusion of the testing, the Paris Road Landfill sight must be return to its original condition. The staging area and the grind site will be cleaned up at the end of the testing. This would include the removal of all grinding debris and all unused portions of the structures that were stored on site. These materials will be kept wet and loaded for transport properly burrito wrapped. This debris will be taken to an asbestos containing landfill that the Parish normally uses.

The grinder debris will be tested to determine if it is required to go to a hazardous waste landfill. If testing is positive, it will be handled as a hazardous waste and properly disposed. If the testing is negative, the grinding debris will be disposed of as stated above.

SECTION 12 References

Bickel, P.J., and K.A. Doksum. Mathematical Statistics: Basic Ideas and Selected Topics. Holden-Day, San Francisco. 1977.

USEPA, 1995. User's Guide for Industrial Source Complex (ISC3) Dispersion Models. Volume II - Description of Model Algorithms, EPA-454/B-95-003b.

SECTION 13 Sampling and Analysis Plan for Buildings to be Demolished

01.30.08

SAMPLING AND ANALYSIS PLAN:

PRE-DEMOLITION ASBESTOS and LEAD INSPECTION OF BUILDINGS to be DEMOLISHED and USED for GRINDER and ACD OPERATION PILOT TEST as a RESULT of HURRICANE KATRINA

Prepared by:

U.S. EPA, Office of Research & Development
National Risk Management Research Laboratory
26 West Martin Luther King Drive
Cincinnati, OH 45268

APPROVAL SHEET

Holly Wooten Date
Project Manager
Cadmus, Inc.
Cincinnati, OH 45240

David Ferguson Date
Task Order Manager
ORD, NRMRL, U.S. EPA
Cincinnati, OH 45268

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1.0 PROJECT DESCRIPTION AND ORGANIZATION

1.1 Project Description

The U.S. EPA's Office of Research and Development (ORD) and the Toxics Enforcement Section (Region VI) is conducting a pilot evaluation of the effectiveness of the use of a grinder and of an Air Curtain Destructor to reduce the building debris volume required for disposal in landfills.

The candidate buildings selected for demolition will be identified by the St Bernard Parish contractors. Only buildings safe for limited entry will be comprehensively sampled in accordance with NESHAP (40 CFR 61, Subpart M). In other cases, samples of the building and/or building debris will be collected to the extent that a safe condition permits. Every reasonable effort will be made to obtain the samples required to characterize the structure.

In accordance with the asbestos NESHAP, a comprehensive pre-demolition inspection will be conducted to identify the type, quantity, and location of regulated asbestos-containing material (RACM) in the buildings. In accordance with OSHA Standard 29 CFR 1926 §62 the buildings are being surveyed for inorganic lead.

1.2 Organization

Holly Wooten, Cadmus, Inc. (EQ) will serve as the Project Manager. She will be responsible for overall project management and coordination of the inspection.

The building inspections will be conducted by a Louisiana Department of Environmental Quality (ADEQ) licensed Asbestos Consultant.

Bureau Veritas North America, Inc., 3380 Chastain Meadows Parkway, Suite 300, Kennesaw, GA 30144 will analyze the bulk samples of building materials for asbestos and paint chip samples for inorganic lead. This laboratory is currently accredited by the National Institute of Standards and Technology (NIST) under its National Voluntary Laboratory Accreditation Program (NVLAP). It is also accredited by the American Industrial Hygiene Association (AIHA) and successfully participate in the National Institute for Occupational Safety and Health (NIOSH) Proficiency Analytical Testing (PAT) Program.

2.0 ASBESTOS SAMPLING

A comprehensive inspection will be conducted of the interior and exterior of the buildings in accordance with EPA's Asbestos Hazard Emergency Response Act (AHERA, 40 CFR §763) to determine the presence of RACM. The interior inspection will include but not necessarily limited to, resilient flooring and wall systems (including applicable interstitial spaces), mechanical systems (including plumbing and heating), as well as the attic space. The exterior inspection will include but not necessarily limited to, roofing systems, cladding, caulking, and glazing compounds.

Collection of samples will be conducted in accordance with AHERA. Samples will be collected using wet methods in order to minimize the potential for asbestos fiber release. All sampling tools will be decontaminated between uses in order to prevent cross-contamination of samples. The following procedures will be used in conducting the inspections of the buildings.

2.1 Identification of Homogeneous Materials

Prior to sampling, each homogeneous material will be categorized as surfacing material, thermal system insulation, or a miscellaneous material. The specific material in each category will be identified; e.g., roofing shingles. A homogeneous material will be determined by the same color, texture, size, and boundary of the building. At a minimum, three samples will be collected and analyzed per homogeneous area.

2.2 Sampling of Roofing Systems

The roofing system may contain multiple layers of homogeneous materials such as shingles and roofing felt. Each layer will be sampled and analyzed as a discrete[6] sample. This means that multiple layers of one sample *will not be composited for analysis*. Each bulk[7] sample will be approximately 4 square inches in size; 2-inches by 2-inches. The samples will be collected using a clean roofing knife. The knife will be cleaned with a disposable wipe after each sample is collected. Each bulk sample will be placed in a labeled plastic bag (≥4-mil industrial weight); each sample will be double-bagged.

2.3 Sampling of Resilient Flooring Systems

The resilient flooring systems may contain multiple layers of homogeneous materials such resilient flooring, paper underlayment, and mastic. Each layer will be sampled and analyzed as a discrete sample; multiple layers of one sample *will not be composited for analysis*. The samples will be collected using a clean roofing knife or similar tool. Each bulk sample will be approximately 4 square inches in size; 2-inches by 2-inches. The tool will be cleaned with a disposable wipe after each sample is collected. Each bulk sample will be placed in a labeled plastic bag (≥4-mil industrial weight); each sample will be double-bagged.

2.4 Sampling of Glazing Compound

Each bulk sample will be approximately 2 square inches in size; e.g., approximately 0.5 inch by 4 inches. The samples will be collected using a clean roofing knife or similar tool. The tool will be cleaned with a disposable wipe after each sample is collected. Each bulk sample will be placed in a labeled plastic bag (≥4-mil industrial weight); each sample will be double-bagged.

2.5 Sampling of Wallboard Systems

The gypsum wallboard system will be sampled in accordance with the supplementary guidance on bulk sample collection and analysis offered by EPA on September 30, 1994 entitled "*Asbestos Sampling Bulletin*." This guidance bulletin offers a suggested strategy for distinguishing between joint compound found at joints in wallboard systems or when the material was applied as a skim coat over the wall surface.

2.5.1 Sampling of Joint Compound

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6 A discrete sample is individually distinct and visually recognizable.

7 A bulk sample is a representative portion of a building material taken at one distinct location for qualitative and quantitative identification of asbestos. In a multilayered system, a discrete sample representative of each portion of each layer will be obtained.

Bulk samples will be collected at wallboard joint intervals (Figure 2). Depending on the placement of the wallboard and stud spacing, the joint intervals may be located approximately 4-feet from corners on wall stud or approximately 4-feet above the floor line. *Note:* Sampling will not be performed at the inside or outside of wall corners due the presence of metal lathe.

At each location a 2-inch diameter full-depth bulk sample will be collected of the wallboard using a hole-saw (*crown saw*[8]) attached to an electric powered variable speed drill. *Note:* If the 2-inch diameter bulk sample crumbles or breaks down at the time of sample collection, a 3-inch diameter sample will be collected. Sufficient care will be exercised by the building inspector to remove the bulk sample intact from the hole-saw. Prior to sampling the interior surface of the hole-saw will be sprayed with a silicone lubricant to increase the releasability of the intact bulk sample. The tool will be cleaned with a disposable wipe after each sample is collected. Each bulk sample will be placed in a labeled plastic bag (≥4-mil industrial weight); each sample will be double-bagged.

Each sample will be packaged to ensure that it remains intact until it reaches the analytical laboratory. In the laboratory the full-depth core sample will be separated into its discrete layers (Figure 2) for analysis (see Section 3.0 "Analytical).

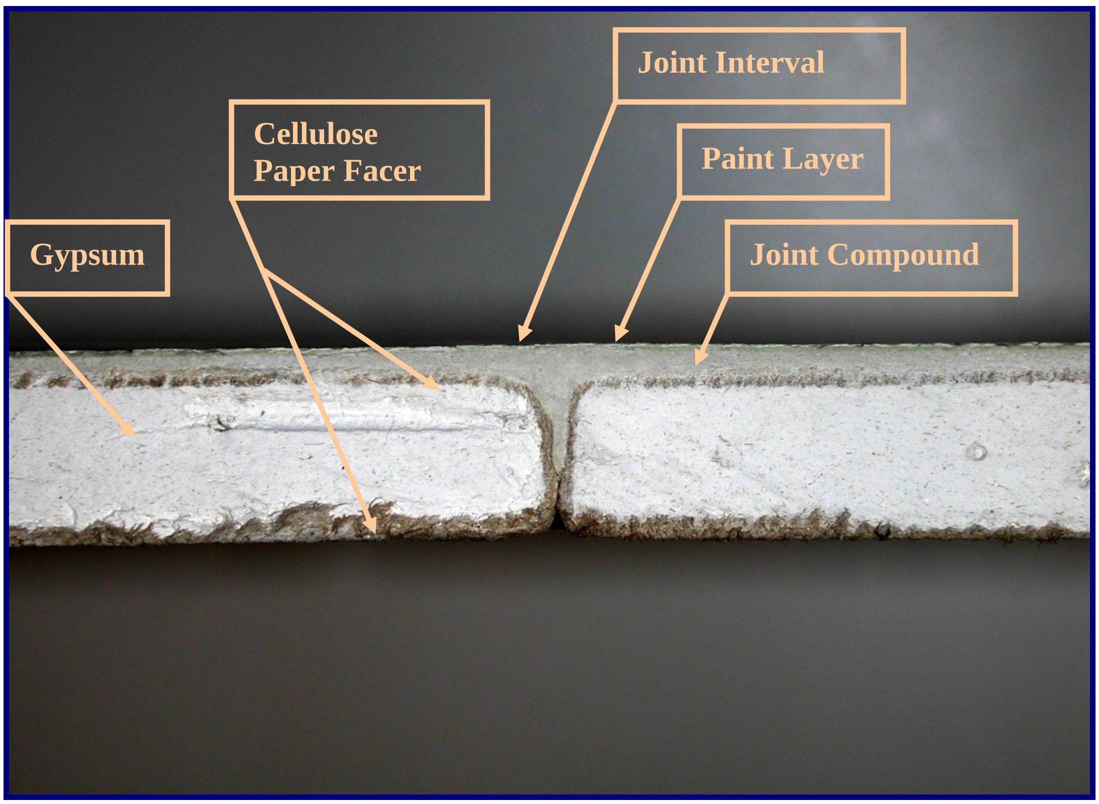

Figure 2. Section of ½-inch gypsum wallboard showing a multi-layered joint interval.

[8] A saw with a hollow rotating cylinder that has teeth around the edge for drilling round holes in building materials.

2.5.2 Sampling of Add-On Application (Skim Coat)

At each location a 3-inch diameter full-depth bulk sample will be collected of the wallboard using a hole-saw (*crown saw*) as described above. The bulk samples will be collected where wallboard joint interval's and framing studs are not present. The samples will be collected as described for the joint compound at wallboard intervals. In the laboratory the full-depth core sample will be separated into its discrete layers (Figure 2) for analysis (see Section 3.0 "Analytical).

2.6 Other Suspect Asbestos-Containing Building Materials

Other suspect asbestos-containing building materials (e.g., thermal system insulation) will sampled in accordance with the sampling protocol outlined in AHERA.

2.7 Sample Identification

Each sample will have a unique sample number identification to ensure that the sample is clearly identified. The number identification will include a three part system. The 1st part will represent the homogeneous material sequence; the 2nd part the homogeneous material; and the 3rd part the numerical sample sequence. The sample identification will also include the street address for the structure sampled.

2.8 Sample Location Documentation

A digitized image will be taken of each sample location. An appropriate label identifying the sample number will be photographed to identify the sample location; i.e., street address. A description of each sampling location will be recorded in the field notes and on a drawing.

2.9 Shipment of Samples to the Laboratory for Analysis

The sample chain-of-custody will be initiated and the samples will be shipped directly from the field to the laboratory for analysis using a one-day (overnight) courier service. The samples will be shipped to Bureau Veritas North America, Inc., 3380 Chastain Meadows Parkway, Suite 300, Kennesaw, GA 30144.

2.10 Quantification and Assessment of Condition RACM

Quantification of the RACM is very important. In general, all miscellaneous materials (excluding caulking and glazing compound) and surfacing material will be quantified in square footage. Thermal system insulation, caulking, and glazing compound will be quantified in linear footage.

3.0 LEAD SAMPLING

3.1 Paint Film

Lead in paint film (paint chip) samples will be collected from the interior finishes (e.g., painted gypsum wallboard and millwork) and from the exterior surfaces (e.g., clapboard siding and window sash/frame). The samples will be collected in accordance with Appendix 13.2 '*Paint Chip Sampling*" of the HUD Guidelines (1997 Revision). At a minimum, one sample will be collected per material. The paint chip sample will be obtained from approximately a 2-square inch area (1-inch by 2-inch). The paint will be scraped directly off the substrate using a clean 1-inch wide wood chisel or similar tool. The paint film will be removed to bare substrate. The paint sample will be placed into a labeled centrifuge tube with screw cap for shipment to the laboratory.

3.2 Sample Location Documentation

A digitized image will be taken of each sample location. An appropriate label identifying the sample number will be photographed to identify the sample location; i.e., street address of the structure sampled. A description of each sampling location will be recorded in the field notes and on a drawing.

3.3 Shipment of Samples to the Laboratory for Analysis

The sample chain-of-custody will be initiated and the samples will be shipped directly from the field to the laboratory for analysis using a one-day (overnight) courier service. The samples will be shipped to Bureau Veritas North America, Inc., 3380 Chastain Meadows Parkway, Suite 300, Kennesaw, GA 30144

4.0 ANALYTICAL

4.1 Asbestos

4.1.1 Building Materials

The samples will be analyzed for asbestos content using polarized light microscopy (PLM) and dispersion staining in accordance with EPA method entitled "*Method for the Determination of Asbestos in Bulk Building Materials*" (EPA/600/R-93/116, July 1993). Point counting will completed on all samples showing >1≤10% asbestos in accordance the "*Method for the Determination of Asbestos in Bulk Building Materials"* (EPA/600/R-93/116, July 1993).

For materials composed of distinct layers (Figure 2) or two or more distinct building materials, each layer or distinct building material will be treated as a discrete sample. The relative proportion of each in the sample will be recorded. The layers or materials will be separated and analyzed individually. *Note:* Each layer or material will be checked for homogeneity during the stereomicroscopic analysis to determine the extent of sample preparation and homogenization necessary for successful PLM analysis. If there is any uncertainty regarding the homogeneity of the layer or material the entire sample or sub-sample will be homogenized for analysis.

The laboratory will report a *single value for each material or discrete layer*. In addition, the laboratory will report a combined (weighted) value for multi-layered materials such as joint compound of a wallboard system. *Note:* All samples for each homogeneous material will be analyzed regardless of whether the 1st sample is positive.

Joint Compound in Wallboard Systems— The 2-inch (or 3-inch) diameter full-depth core sample will be sub-sampled at the centerline of the joint to include ¼-inch (but not more than ⅜-inch) of the wallboard system on either side of joint. This will yield a sample with approximate dimensions 2-inches (L) by ½-inch (W). The sub-sample will then be separated into its discrete layers for analysis, as feasible. For example, it *may not be feasible* to separate the paint from the joint compound.

Add-On Application (Skim Coat)— The 2-inch (or 3-inch) diameter full-depth core sample will be sub-sampled at the centerline of the sample include ¼-inch (but not more than ⅜-inch) of the wallboard system on either side of centerline of the sample. This will yield a sample with approximate dimensions 2-inches (L) by ½-inch (W). The sub-sample will then be separated into its discrete layers for analysis, as feasible.

4.2 Inorganic Lead

4.2.1 Paint Chips

The paint chip samples will be prepared for analysis in accordance with EPA SW-846 Method 3050 and analyzed by ICP-AES in accordance with EPA SW-846 Method 6010.

5.0 QUALITY ASSURANCE (QA)/QUALITY CONTROL (QC)

5.1 Chain-of-Custody Procedures

Strict chain-of-custody procedures will be followed. Sample chain-of-custody procedures will be in accordance with ASTM Standard D 4840-99 "Standard Guide for Sample Chain-of-Custody Procedures."

5.2 Selection of Laboratory

Bureau Veritas North America, Inc., 3380 Chastain Meadows Parkway, Suite 300, Kennesaw, GA 30144 will analyze the bulk samples of building materials for asbestos and the paint chip samples for inorganic lead. This laboratory is currently accredited by the National Institute of Standards and Technology (NIST) under its National Voluntary Laboratory Accreditation Program (NVLAP). It is also accredited by the American Industrial Hygiene Association (AIHA) and successfully participate in the National Institute for Occupational Safety and Health (NIOSH) Proficiency Analytical Testing (PAT) Program.

5.3 Duplicate Field Samples

The performance of the laboratory will be evaluated using duplicate samples; i.e., the samples will be collected side-by-side. The samples will be sent to the same laboratory for analysis. This will serve as a check on the analytical variability within the same laboratory, as well as the measured variability associated with the sampling process and the material homogeneity. Each of the quality control samples will be labeled independently so that the identity of the QC samples cannot be determined except by reference to the field sampling records maintained by the building inspector.

5.3.1 Asbestos

For every homogeneous material, a duplicate sample will be collected and analyzed of every 10 samples unless the total sample size is less than 10. If the latter is the case, one duplicate sample will be collected and analyzed. Laboratory results on these QC samples should not disagree on the presence or absence of asbestos; i.e., <1% vs. >1% asbestos. Any disagreement about the presence/absence of asbestos will be resolved by additional analysis.

5.3.2 Lead

A duplicate sample will be collected and analyzed of every 10 samples unless the total sample size is less than 10. If the latter is the case, one duplicate sample will be collected and analyzed.

5.3 Method Specified QA/QC Samples

5.4.1 Asbestos

QA/QC samples will be analyzed as specified in the test method "*Method for the Determination of Asbestos in Bulk Building Materials*" (EPA/600/R-93/116, July 1993). These analyses will be included in the laboratory report.

5.4.2 Lead

QA/QC samples will be analyzed as specified in EPA SW-846 Method 6010. These analyses will be included in the laboratory report.

6.0 REPORTING

The inspection report will be prepared that includes the following information for each of the four buildings:

- Description of the building survey and methodology.

- Description of the samples taken. The description will include the field sample number, laboratory number, location of where the sample was collected, and description of the homogeneous area sampled.

- The laboratory results for asbestos and lead analysis will be reported as described in the respective methods. The fully-executed chain-of-custody records will be included as an appendix to the report.

- An inventory of all RACM including the location of RACM, approximate quantities of RACM, NESHAP category (friable, non-friable Category I or non-friable Category II), and category of RACM (surfacing, TSI, or miscellaneous material), and the specific material in each category (e.g., resilient flooring mastic).

- The names and proof of AHERA Asbestos Building Inspector training and applicable LDEQ license for the individual(s) who performed the inspection.